MEK- 7222J
MEK- 7222K

SERVICE MANUAL

Celltac E

AUTOMATED HEMATOLOGY ANALYZER

MEK-7222

0634-001896A

NIHON KOHDEN

Model: MEK-7222J/K
Manual code no.: 0634-001896A

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This manual is organized.	1	2	3	4	5
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EMC RELATED CAUTION

This equipment and/or system complies with the International Standard EN61326-1 for electromagnetic compatibility for electrical equipment and/or system for measurement, control and laboratory use. However, an electromagnetic environment that exceeds the limits or levels stipulated in the EN61326-1, can cause harmful interference to the equipment and/or system or cause the equipment and/or system to fail to perform its intended function or degrade its intended performance. Therefore, during the operation of the equipment and/or system, if there is any undesired deviation from its intended operational performance, you must avoid, identify and resolve the adverse electromagnetic effect before continuing to use the equipment and/or system.

The following describes some common interference sources and remedial actions:

1. **Strong electromagnetic interference from a nearby emitter source such as an authorized radio station or cellular phone:**
   Install the equipment and/or system at another location if it is interfered with by an emitter source such as an authorized radio station. Keep the emitter source such as cellular phone away from the equipment and/or system.

2. **Radio-frequency interference from other equipment through the AC power supply of the equipment and/or system:**
   Identify the cause of this interference and if possible remove this interference source. If this is not possible, use a different power supply.

3. **Effect of direct or indirect electrostatic discharge:**
   Make sure all users and patients in contact with the equipment and/or system are free from direct or indirect electrostatic energy before using it. A humid room can help lessen this problem.

4. **Electromagnetic interference with any radio wave receiver such as radio or television:**
   If the equipment and/or system interferes with any radio wave receiver, locate the equipment and/or system as far as possible from the radio wave receiver.

If the above suggested remedial actions do not solve the problem, consult your Nihon Kohden Corporation subsidiary or distributor for additional suggestions.

This equipment complies with International Standard EN55011 (1999) Group 1, Class B. Class B EQUIPMENT is equipment suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

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Conventions Used in this Manual and Instrument

Warnings, Cautions and Notes

Warnings, cautions and notes are used in this manual to alert or signal the reader to specific information.

WARNING

A warning alerts the user to the possible injury or death associated with the use or misuse of the instrument.

CAUTION

A caution alerts the user to possible injury or problems with the instrument associated with its use or misuse such as instrument malfunction, instrument failure, damage to the instrument, or damage to other property.

NOTE

A note provides specific information, in the form of recommendations, prerequirements, alternative methods or supplemental information.

Explanations of the Symbols in this Manual and Instrument

The following symbols found in this manual/instrument bear the respective descriptions as given.

On panel

Symbol	Description	Symbol	Description
	AC power off (Disconnection from the mains)		ISOTONAC•3 (diluent)
	AC power on (Connection to the mains)		CLEANAC (detergent)
	Main power lamp		CLEANAC•3 (detergent)
	“On” only for part of the equipment		HEMOLYNAC•3* (hemolysing reagent)
	“Off” only for part of the equipment		HEMOLYNAC•3N* (hemolysing reagent)
	Laser ON		HEMOLYNAC•5 (hemolysing reagent)
	Reset		WASTE
	Clean		Attention, consult operator's manual
	Capillary blood mode		Alternating current
	Count		Equipotential terminal
	Dispense		Printer socket
	Auto print		Serial port 1
	Feed		Bar code reader socket (Serial port 2)
	Print		Biohazard
	Inlet		Year of manufacture
	Outlet		Serial number
	Screen brightness		

* When using the HEMOLYNAC•3N hemolysing reagent, attach the HEMO3N label over the HEMO3 label.

On screen and recorded data

Symbol	Description	Symbol	Description
?	Beside WBC or RBC measured value: Sample error Beside HGB measured value: Dirty measurement baths	✳	Beside HGB measured value: HGB circuit error
!	Beside WBC measured value: Poor hemolyzation Beside HGB measured value: HGB voltage adjustment error Beside MCHC measured value: Abnormal MCHC	C	Beside WBC or PLT measured value: Platelet coagulation

Section 1 General

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Introduction

CAUTION

To maintain the instrument in normal condition, the user must perform the periodic maintenance. Refer to "Maintenance" of the operator's manual.

This service manual provides useful information to qualified service personnel to understand, troubleshoot, service, maintain and repair the MEK-7222 Hematology Analyzer (referred to as "the instrument" in this service manual).

The maintenance must be periodically performed because the instrument has fluid paths and precision parts. Accordingly, the user is responsible for performing the periodic maintenance. The "Maintenance" section in this service manual describes the maintenance that should be performed by qualified service personnel. The "Maintenance" section in the operator's manual describes the maintenance that can be performed by the user.

NOTE

If the instrument has a problem and there has been no periodic maintenance, the instrument will usually be normal again by cleaning the fluid paths or replacing a consumable with a new one.

The information in the operator's manual is primarily for the user. However, it is important for service personnel to thoroughly read the operator's manual and service manual before starting to troubleshoot, service, maintain or repair this instrument. This is because service personnel needs to understand the operation of the instrument in order to effectively use the information in the service manual.

Service Policy

CAUTION

- **Be careful not to directly touch any place where blood is or may spread to.**
- **Wear rubber gloves to protect yourself from infection before doing maintenance.**

Nihon Kohden Corporation's basic policy for technical service is to replace faulty units, printed circuit boards or parts. We do not support component-level repair of boards and units outside the factory.

NOTE

- **When ordering parts or accessories from your nearest Nihon Kohden Corporation's distributor, please quote the NK code number and part name which is listed in this service manual, and the name or model of the unit in which the required part is located. This will help us to promptly attend to your needs.**
- **Always use parts and accessories recommended or supplied by Nihon Kohden Corporation to assure maximum performance from your instrument.**

Specifications

Measured Parameters, Ranges and Reproducibility to Specimen from Venous Blood

Specifications except WBC population were determined using hematology control blood (MEK-3DN), counted 10 times consecutively.

Measured Parameters	Measuring Range	Reproducibility to Specimen from Venous Blood (CV: Coefficient of Variation)
WBC: White blood cell count	0 to 300 × 10^3/μL	within 2.0%CV (4.0 to 9.0 × 10^3/μL)
NE%: Neutrophil percent	0 to 99.9%	within 5.0%CV (WBC: 4.0 to 9.0 × 10^3/μL, NE%: 40 to 70%)
LY%: Lymphocyte percent	0 to 99.9%	within 5.0%CV (WBC: 4.0 to 9.0 × 10^3/μL, LY%: 20 to 45%)
MO%: Monocyte percent	0 to 99.9%	within 12.0%CV (WBC: 4.0 to 9.0 × 10^3/μL, MO%: 2 to 10%)
EO%: Eosinophil percent	0 to 99.9%	within 20.0%CV (WBC: 4.0 to 9.0 × 10^3/μL, EO%: 2 to 10%)
BA%: Basophil percent	0 to 99.9%	within CV30.0% (>2%) or average value ±1% (0 to 2%) (WBC: 4.0 to 9.0 × 10^3/μL, BA%: 0 to 3%)
NE: Neutrophil count	0 to 99.9 × 10^3/μL	
LY: Lymphocyte count	0 to 99.9 × 10^3/μL	
MO: Monocyte count	0 to 99.9 × 10^3/μL	
EO: Eosinophil count	0 to 99.9 × 10^3/μL	
BA: Basophil count	0 to 99.9 × 10^3/μL	
RBC: Red blood cell count	0 to 14.9 × 10^6/μL	within 1.5%CV (5.0 × 10^6/μL)
HGB: Hemoglobin concentration	0 to 29.9 g/dL	within 1.5%CV (16 g/dL)
HCT: Hematocrit	0 to 99.9%	
MCV: Mean cell volume	20 to 199 fL	within 1.0%CV (70 to 120 fL)
MCH: Mean cell hemoglobin	10 to 50 pg	
MCHC: Mean cell hemoglobin concentration	10 to 50 g/dL	
RDW: Red blood cell distribution width	0 to 50%	
PLT: Platelet count	0 to 1490 × 10^3/μL	within 4.0%CV (3.0 × 10^3/μL)
PCT: Platelet crit	0 to 2.9%	
MPV: Mean platelet volume	0 to 20.0 fL	
PDW: Platelet distribution width	0 to 50%	

Detection Method

Blood cell count: Electrical resistance detection
Hemoglobin: Cyanmethemoglobin optical detection
Hematocrit: Histogram calculation
WBC population: Light scatter by laser
Platelet crit: Histogram calculation
RBC distribution width: Histogram calculation
Platelet distribution width: Histogram calculation

Standardization Analysis Method

WBC: ICSH1988 ICSH: The assignment of values to fresh blood used for calibrating automated blood cell counters. Clin Lab Haematol, 10:203-212, 1988
RBC: ICSH1988 ICSH: The assignment of values to fresh blood used for calibrating automated blood cell counters. Clin Lab Haematol, 10:203-212, 1988

HGB: NCCLS H15-A2 H15-A2: Reference and Selected Procedures for the Quantitative Determination of Hemoglobin in Blood Second Edition; Approved Standard (1994)

HCT: NCCLS H7-A2 H7-A2: Procedure for Determining Packed Cell Volume by the Microhematocrit Method Second Edition; Approved Standard (1993)

PLT: Brecher & Cronkite

Interference Substances

WBC: **Unlysed red cells**

In some rare occasions, the RBC in the blood sample may not completely lyse and these non-lysed RBC may be detected as WBC and cause increase in WBC count.

Multiple myeloma

The precipitation of proteins in multiple myeloma patients may increase the WBC count.

Leukemia

WBC is fragile in leukemia patient and WBC may be destroyed during measurement. These WBC fragments may also interfere with WBC differential measurement.

Chemotherapy

Cytotoxic and immunosuppressive drugs cause low WBC count.

Cryoglobulins

Cryoglobulin may be increased in patients who are or have myeloma, cancer, leukemia, macroglobulinemia, lymphoproliferative disorders, metastatic tumors, autoimmune disorders, infections, anerurism, pregnant, thromboembolic phenomena, diabetes, etc, which cause increase in WBC, RBC or PLT counts and HGB concentration. In such cases, warm the blood sample to 37°C in a water bath for 30 minutes and measure the sample immediately.

RBC: **Leukemia**

An increase in WBC in leukemia patient causes increase in RBC.

Agglutinated RBC

Agglutinated RBC may decrease RBC count. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Cold agglutinins

IgM immunoglobulins which are elevated in clod agglutinin disease may decrease RBC and PLT counts and increase MCV.

HGB: **Turbidity of the blood sample**

Any physiologic and/or therapeutic factors may increase HGB. In such a case, determine the cause of turbidity and follow the appropriate method below.

1. Increased WBC
   An extreme increase in WBC will cause excessive light scatter. In these cases, measure manually. Centrifuge the diluted sample and measure the supernatant fluid with a spectrophotometer.
2. Increased lipids
   The blood sample may be milky when there is excessive lipid. This may occur with hyperlipidemia, hyperproteinemia and hyperbilirubinemia. Accurate HGB measurement can be achieved by manual methods and a plasma blank.
3. Increased turbidity
   When RBC are resistant to lysing, turbidity may increase causing increase in HGB. Observe if MCH and MCHC values are abnormal. HGB result affects MCH and MCHC result.
4. Fetal bloods
   The mixing of fetal and maternal blood may increase HGB value.

HCT: **Agglutinated RBC**

RBC agglutination may cause erroneous HCT and MCV values. Observe if MCH and MCHC values are abnormal. In such a case, measure manually.

MCV: **Agglutinated RBC**

RBC agglutination may cause erroneous HCT and MCV values. Observe if MCH and MCHC values are abnormal. In such a case, measure manually.

Excessive number of large PLT

Excessive number of large PLT and/or excessively high WBC may affect the MCV value. Check by careful examination of the stained blood film.

MCH: MCH is determined from HGB and RBC values. Therefore, the limitations for HGB and RBC also affect MCH value.

MCHC: MCHC is determined from HGB and HCT values. Therefore, the limitations for HGB and HCT also affect MCHC value.

RDW: RDW is determined from RBC value. Therefore, the limitations for RBC also affect RDW value.

Agglutinated RBC

Agglutinated RBC may decrease RBC count and erroneous RDW. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Nutritional deficiency or blood transfusion

Iron and/or cobalamin and/or folate deficiency may increase RDW.

PLT: **Very small fragments**

Very small RBC, RBC fragments and WBC fragments may be the cause in increased PLT count.

Agglutinated RBC

PLT may be trapped in the agglutinated RBC resulting in decrease in PLT. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Very large PLT

Large PLT may exceed the PLT threshold and may not be counted which results in low PLT count.

Chemotherapy

Cytotoxic and immunosuppressive drugs may increase the fragility of cells which may cause low PLT count. In such a case, measure manually.

Hemolysis

Hemolyzed specimens contain red cell stroma which may increase PLT count.

Anticoagulated blood

Blood anticoagulated with acid-citrate-dextrose may have clumped PLT which may cause decrease in PLT count.

Agglutinated PLT

Clumped PLT may decrease PLT count and/or increase WBC count. For such sample, collect the sample in sodium citrate anticoagulant and measure only PLT. The PLT result must be corrected for the sodium citrate dilution effect.

MPV: **Very large PLT**

Large PLT may exceed the PLT threshold and not be counted which results in low MPV.

Very small fragments

Very small RBC, RBC fragments and WBC fragments may interfere with MPV measurement.

Agglutinated RBC

PLT may be trapped in the agglutinated RBC resulting erroneous MPV. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Chemotherapy

Cytotoxic and immunosuppressive drugs may affect MPV. In such a case, measure manually.

NOTE

Blood samples collected in EDTA does not maintain stable MPV because platelets swell depending on the interval after collection and storage temperature.

WBC 5 part differential parameters are derived from the WBC count, therefore, the limitations for WBC also affect these parameters.

LY and LY%: Erythroblasts, certain parasites and RBC that are resistant to lysis may interfere with an accurate LY count.

MO and MO%: Large lymphocytes, atypical lymphocytes, blasts and excessive number of basophils may interfere with an accurate MO count.

NE and NE%: Excessive eosinophils, metamyelocytes, myelocytes, promyelocytes, blasts and plasma cells may interfere with an accurate NE count and NE%.

EO and EO%: Abnormal granules may interfere with an accurate EO count.

BA and BA%: Immature cell, metamyelocytes, myelocytes, promyelocytes, blasts and plasma cells may interfere with an accurate BA count and BA%.

Dilution Ratio

- Venous blood

Sample volume:	55 µL (for 22 parameters)/30 µL (for WBC, RBC, HGB, HCT, MCV, MCH, MCHC and PLT)	
WBC/HGB:	200:1	
RBC/PLT:	40,000:1	

- Capillary blood

Sample volume:	10 µL	20 µL
WBC/HGB:	1200:1	600:1
RBC/PLT:	240,000:1	120,000:1

Counting Time

Within 70 s/sample (from measurement start to data display)

Display

Display:	5.5 inch LCD with backlight and touch screen keys
Resolution:	320 × 240 dots
Screen size:	approx. 86 × 115 mm
Display contents:	Numerical data, scattergrams, histograms, measuring conditions, alarm message and other messages, touch screen keys

Data Storage

Numerical data for all counted parameters for up to 400 samples and histograms and scattergrams for up to 50 samples

Environmental Conditions

Storage temperature:	–20 to 60°C
Operating temperature:	15 to 30°C
Storage humidity:	10 to 95% (Non-condensing)
Operating humidity:	30 to 85% (Non-condensing)
Storage atmospheric pressure:	70 to 106 kPa
Operating atmospheric pressure:	70 to 106 kPa

Power Requirements

Power requirements:	MEK-7222J: 110, 117 or 127 V ±10% AC, 50/60 Hz
	MEK-7222K: 220, 230 or 240 V ±10% AC, 50/60 Hz
Power consumption:	250 VA

Dimensions and Weight

Dimensions: 382 W × 485 D × 520 H (mm)
Net weight: approx. 38 kg

Electromagnetic Compatibility

IEC 61326-1 (1997) Amendment 1 (1998) Amendment 2 (2000)
EN 61326-1 (1997) Amendment 1 (1998)

CISPR11 (1997), Group 1, Class B
EN 55011 (1998) Amendment 1 (1999), Group 1, Class B
The power supply short interruption test is performed through the transformer which has three times or more as large capacity as the instrument.

Safety

Safety standards: IEC 61010-1 2nd Edition (2001)
EN 61010-1 2nd Edition (2001)

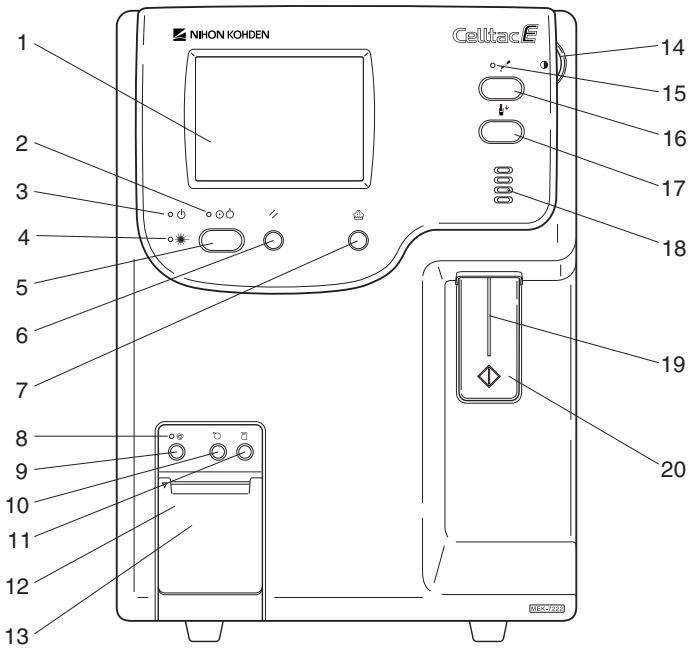
Laser: IEC 60825-1 (1993) Amendment 1 (1997), Class 1
EN 60825-1 (1994) Amendment 11 (1996)

According to the type of protection against electrical shock: CLASS I EQUIPMENT
According to the degree of protection against harmful ingress of water: IPX0 (Ordinary EQUIPMENT)
According to the degree of safety of application in the presence of a FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE: EQUIPMENT not suitable for use in the presence of FLAMMABLE ANAESTHETIC MIXTURE WITH AIR, OR WITH OXYGEN OR NITROUS OXIDE
According to the mode of operation: CONTINUOUS OPERATION
EQUIPMENT types (classification): Indoor stationary EQUIPMENT
Pollution Degree: 2 EQUIPMENT

Requirements for marking of IN VITRO DIAGNOSTIC instruments: EN1658 (1996)

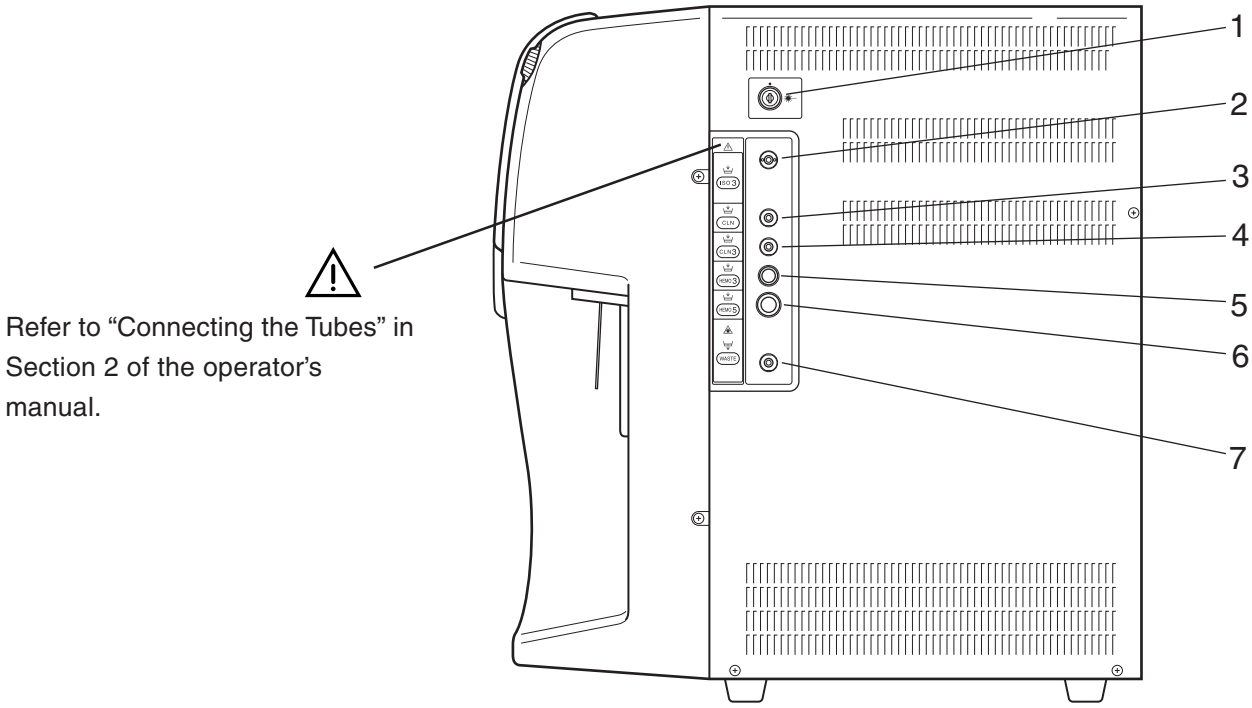
Panel Descriptions

Front Panel



No.	Name	Description
1	LCD display	Displays various messages, measured data and touch screen keys.
2	Power lamp	Lights when the main power switch on the rear panel and power key on the front panel are turned on.
3	Main power lamp	Lights when the main power switch on the rear panel is tuned on.
4	Laser lamp	Lights when the laser switch on the right side panel is turned on.
5	Power key	Turns the hematology analyzer power on or off when the main power switch on the rear panel is turned on. When the power is turned on, priming and self-check are automatically performed, and the READY screen appears.
6	Reset key	Stops operation when pressed during operation. Returns to the READY screen when pressed while changing settings. Use this key only when an error occurs.
7	Clean key	Cleans the fluid path, aperture and manometer with detergent. Automatically primes after cleaning the fluid path. Press this key when clogging occurs, the manometer becomes dirty or bubbles occur in the manometer.
8	Auto print mode lamp	Lights when automatic printing mode is selected (optional).
9	Auto print key	Switches the printing mode between automatic and manual for the WA-720VK printer unit (optional).
10	Feed key	Feeds paper of the WA-720VK printer unit while held down (optional).
11	Print key	Prints measured data on the WA-720VK printer unit (optional).
12	Printer unit (WA-720VK)	Roll printer. Prints out measured data and sample ID no. (optional)
13	Printer door	For the recording paper of the WA-720VK printer unit. To open, pull the upper right corner (optional).
14	Screen brightness control	Adjusts the screen brightness
15	Capillary blood mode lamp	Lights when in capillary blood mode.
16	Capillary blood mode key	Switches the operation mode to capillary blood mode. The capillary blood mode lamp lights.
17	Dispense key	Dispenses diluent (approx. 2 mL) from the sampling nozzle. Available only for the capillary blood mode.
18	Operation indicator lamps	Blinking: Aspirating the sample Off: Counting the sample Lit: Ready for next counting
19	Sampling nozzle	Aspirates the sample. Dispenses the diluent when in the capillary blood mode.
20	Count switch	Aspirates the sample and starts counting.

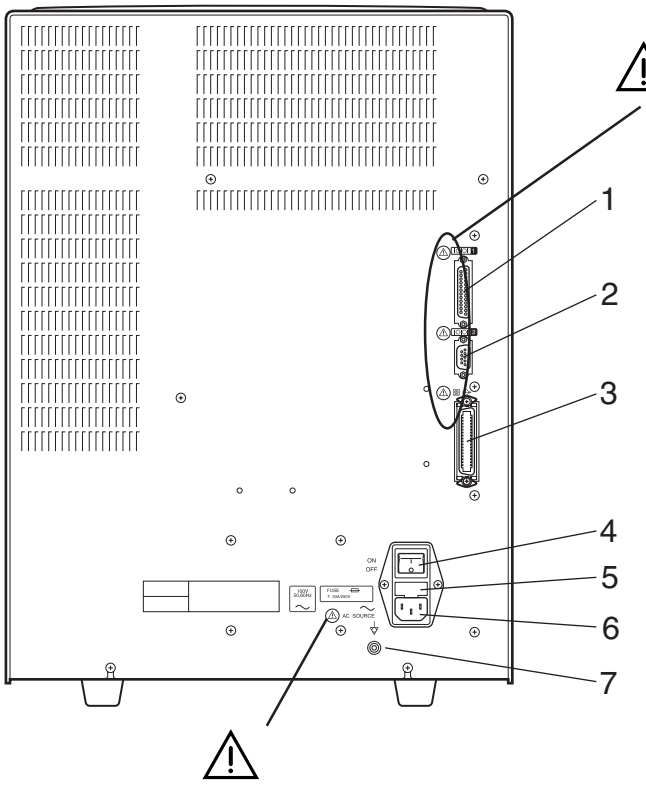
Right Side Panel



No.	Name	Description
1	Laser switch	Turns the laser on or off with the laser key for WBC 5 part differential measurement.
2	ISO3 Diluent inlet	Inlet for the ISOTONAC•3 diluent.
3	CLN Detergent inlet	Inlet for the CLEANAC detergent.
4	CLN3 Detergent inlet	Inlet for the CLEANAC•3 detergent.
5	HEMO3/HEMO3N Hemolysing reagent inlet*	Inlet for the HEMOLYNAC•3 or HEMOLYNAC•3N hemolysing reagent.
6	HEMO5 Hemolysing reagent inlet	Inlet for the HEMOLYNAC•5 hemolysing reagent.
7	WASTE Waste outlet	Outlet for waste such as used lyse, detergent and aspirated samples.

* When using the HEMOLYNAC•3N reagent, attach the HEMO3N label provided with the hematology analyzer to cover the HEMO3 label at the HEMO3 inlet.

Rear Panel



Refer to warnings and cautions in "Connecting an External Instrument to the Hematology Analyzer" in Section 2 of the operator's manual.

Refer to warnings and cautions in "Connecting the Power Cord and Grounding the Hematology Analyzer" in Section 2 of the operator's manual.

No.	Name	Description
1	Serial port	Connects to the optional WA-460V card printer, other external printer or PC. (Serial port 1)
2	Bar code socket	Connects to the optional handy bar code reader. Can be used as a serial port. (Serial port 2) Also supplies the power to the bar code reader. Power supply voltage: 5 VDC (pin 9: 5 V, pin 5: GND) Rated current: 200 mA
3	Printer socket	Connects to an external printer (WA-710V or other).
4	Main power switch	Supplies the power to the hematology analyzer when it is turned on. Under normal conditions keep this switch turned on.
5	Fuse holder	Contains the time lag fuse. To replace the fuse, contact your Nihon Kohden distributor.
6	AC SOURCE AC source socket	Connects the AC power cord to supply AC power to the hematology analyzer.
7	Equipotential ground terminal	Connects the ground lead to the equipotential ground terminal on the wall for earth grounding.

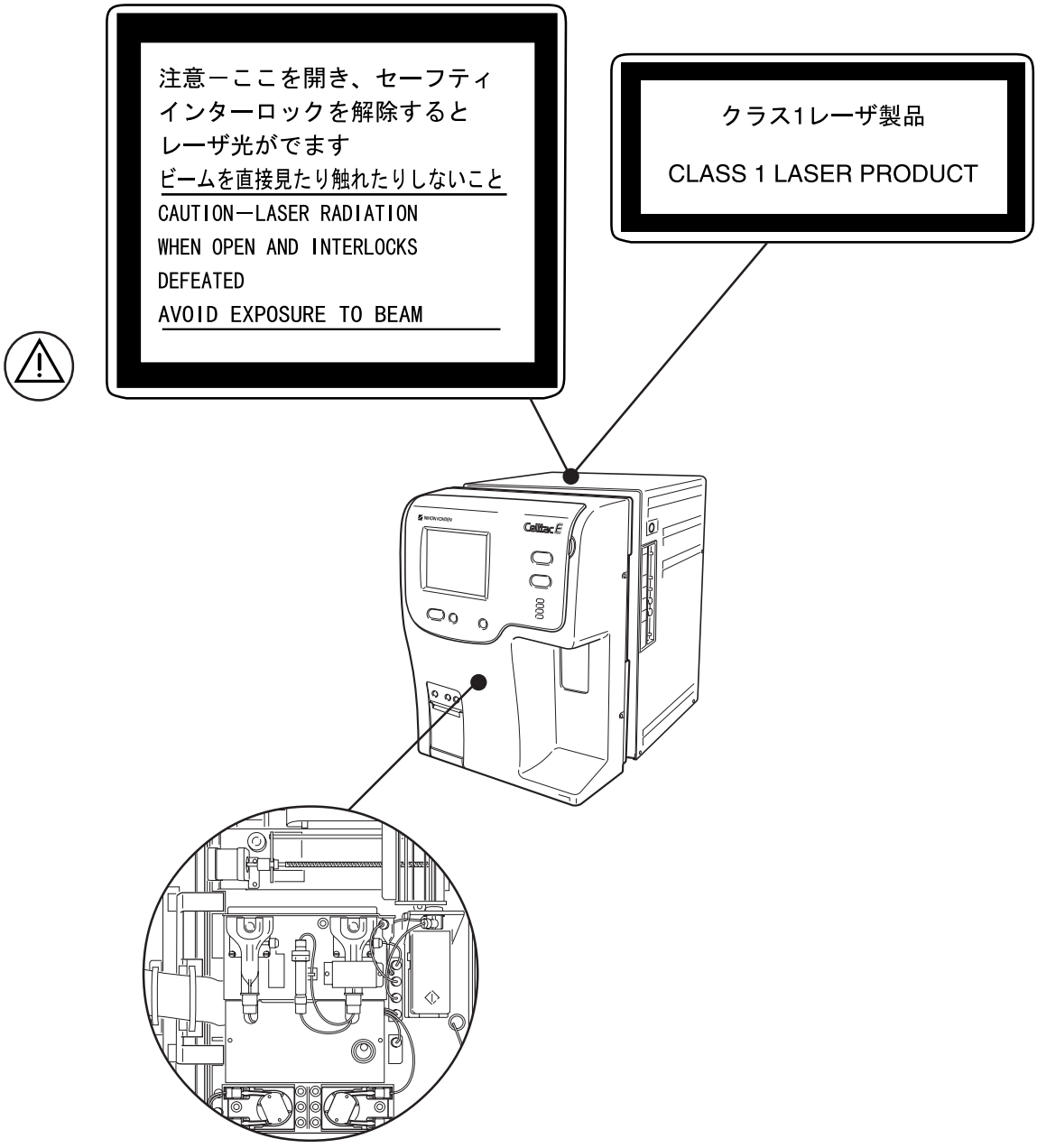
CAUTION

- **In order to avoid any safety hazard, only connect personal computers which are approved by IEC 60950 using the information found in the reference in Section 10.**
- **Only use the 3-prong power cord for the PC.**

Inside Panels

CAUTION

- **For WBC 5 part differential measurement, the laser beam is used. Do not open any part labeled "CAUTION". The laser can cause burns and blindness.**
- **Do not remove the caution labels.**

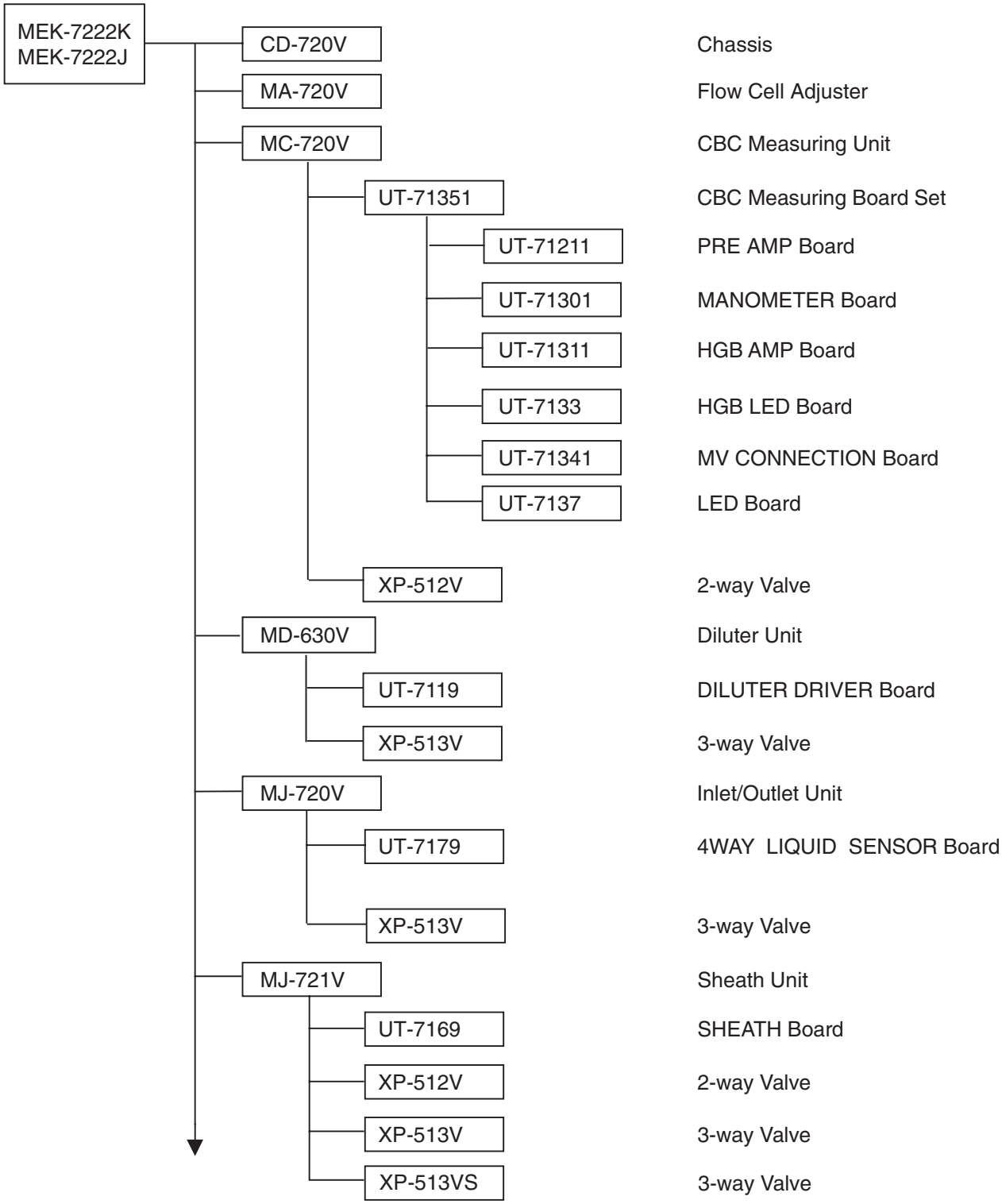


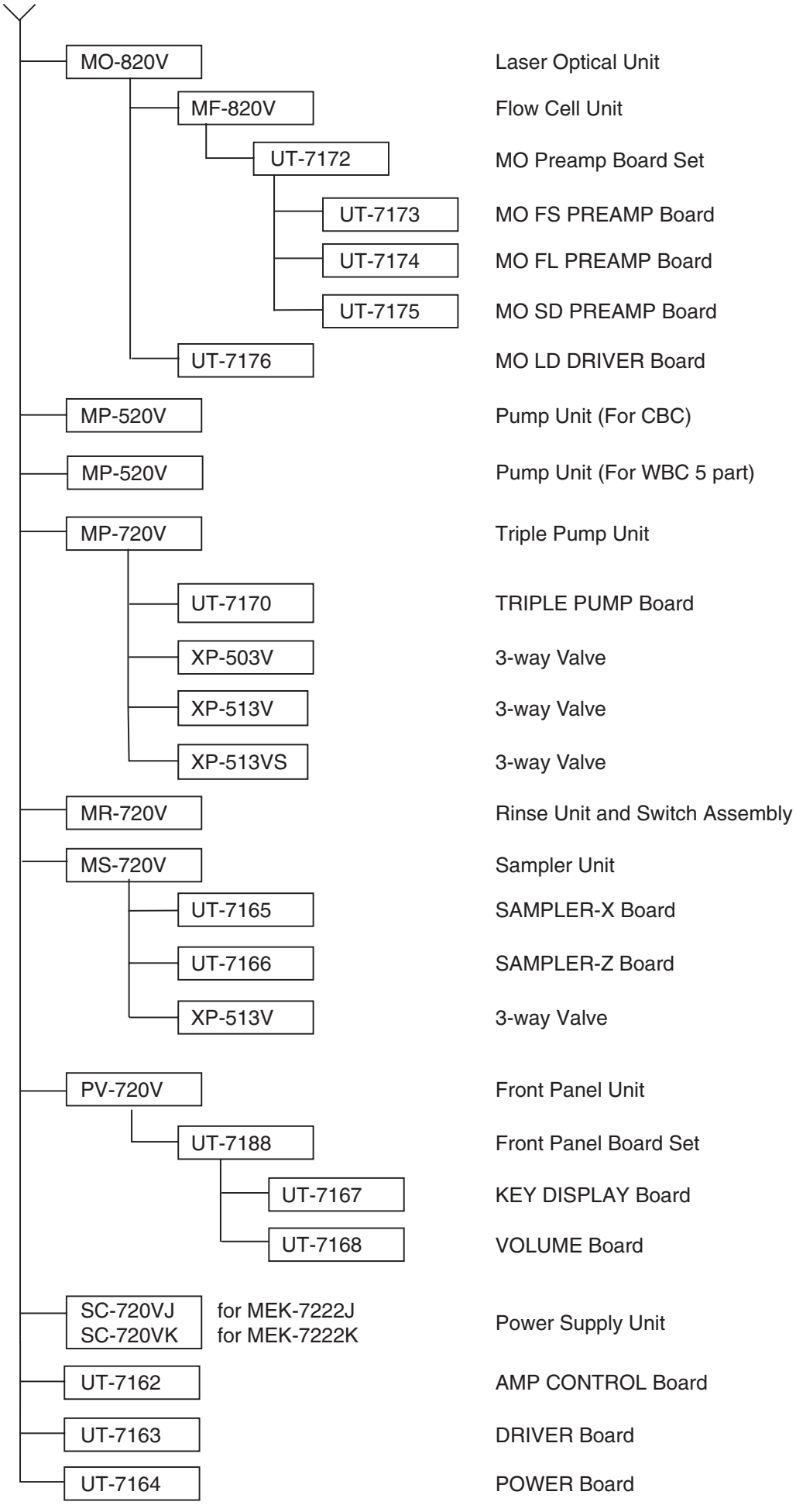
NOTE

- **Replace the filter periodically.**
- **When attaching the filter joint assembly, be careful not to bend or damage the filter packing at the bottom of the measurement bath.**
- **When there is a leakage, check that there is no scratch or damage to the circumference of the filter.**

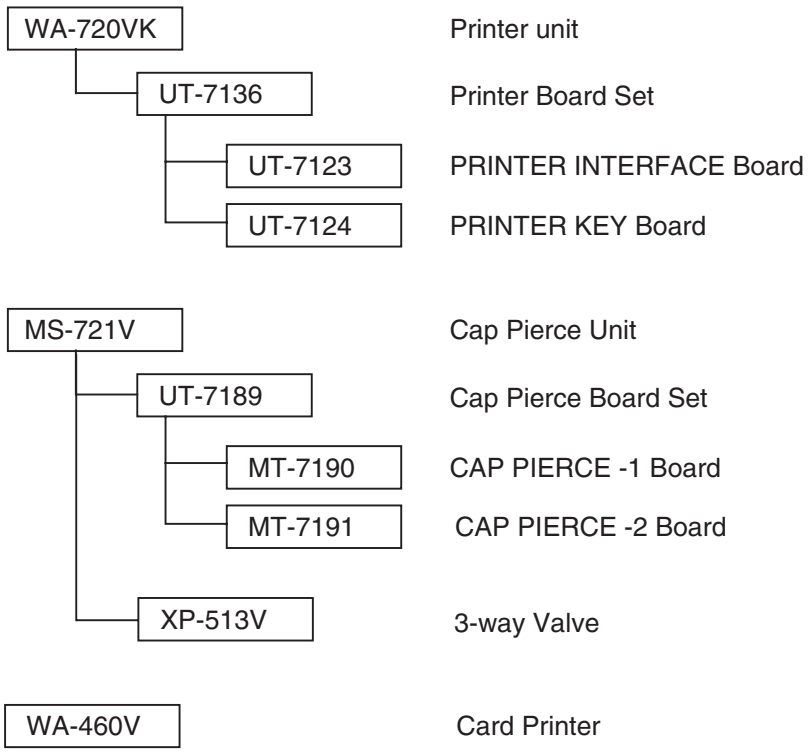
Composition

Standard Composition




MO-820V
Laser Optical Unit
MF-820V
Flow Cell Unit
UT-7172
MO Preamp Board Set
UT-7173
MO FS PREAMP Board
UT-7174
MO FL PREAMP Board
UT-7175
MO SD PREAMP Board
UT-7176
MO LD DRIVER Board
MP-520V
Pump Unit (For CBC)
MP-520V
Pump Unit (For WBC 5 part)
MP-720V
Triple Pump Unit
UT-7170
TRIPLE PUMP Board
XP-503V
3-way Valve
XP-513V
3-way Valve
XP-513VS
3-way Valve
MR-720V
Rinse Unit and Switch Assembly
MS-720V
Sampler Unit
UT-7165
SAMPLER-X Board
UT-7166
SAMPLER-Z Board
XP-513V
3-way Valve
PV-720V
Front Panel Unit
UT-7188
Front Panel Board Set
UT-7167
KEY DISPLAY Board
UT-7168
VOLUME Board
SC-720VJ
SC-720VK
for MEK-7222J
for MEK-7222K
Power Supply Unit
UT-7162
AMP CONTROL Board
UT-7163
DRIVER Board
UT-7164
POWER Board

Options


WA-720VK
Printer unit
UT-7136
Printer Board Set
UT-7123
PRINTER INTERFACE Board
UT-7124
PRINTER KEY Board
MS-721V
Cap Pierce Unit
UT-7189
Cap Pierce Board Set
MT-7190
CAP PIERCE -1 Board
MT-7191
CAP PIERCE -2 Board
XP-513V
3-way Valve
WA-460V
Card Printer

Section 2 Troubleshooting

General 2.1
Error Messages 2.2
System Error Messages 2.5
Inaccurate Counting and Other Problems 2.6

General

If a problem occurs, the built-in error detection function displays an error message with an alarm sound. The tables in the next sections show the types of error message, their causes and their countermeasures. Use them when an error message occurs.

There are two types of error messages.

- Error message when turning the power on
- Error message related to measurement

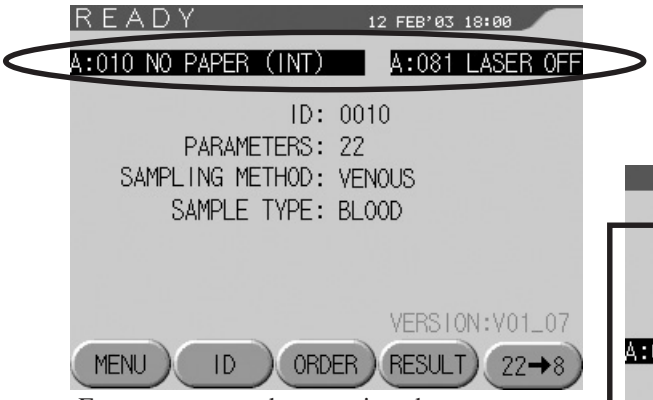
CAUTION

When an alarm occurs, the acquired data may not be correct, especially when the "!" or "sample error" message appears. Do not use the alarmed data.

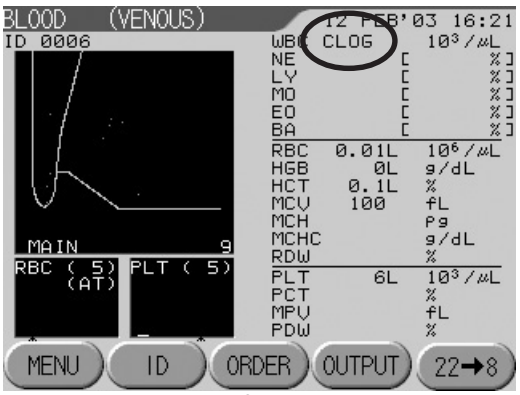
If the hematology analyzer detects an error, the error message appears on the screen as shown below.

NOTE

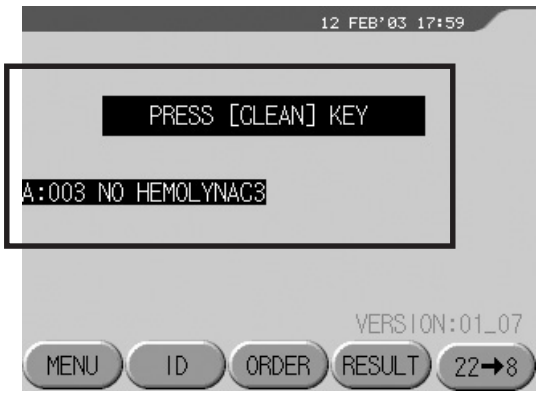
When performing the strong cleaning as the countermeasure, after the strong cleaning is completed, press the count switch without aspirating the diluent from the sampling nozzle. Perform this procedure two or more times so that the diluent replaces the CLEANAC•3 detergent inside the hematology analyzer.



Error message when turning the power on



Error message after measurement



Error message after cleaning or priming

Error Messages

Messages	Possible Cause/Criteria	Countermeasure
A: 001 NO DILUENT A: 002 NO CLEANAC•3 A: 003 NO HEMOLYNAC•3 A: 005 NO CLEANAC A: 007 NO HEMOLYNAC•5	Out of diluent, detergent or hemolysing reagent.	Replace the diluent, detergent or hemolysing reagent. Then press the PRIME key on the OPERATION screen.
A: 021 WBC LEVEL 1 A: 022 WBC LEVEL 2	Erroneous operation during counting.	Press the Clean key to perform cleaning. Then recount the sample. If the alarm still occurs, perform strong cleaning, clean the aperture cap and replace the pump tube.
A: 023 WBC LEVEL 3	The WBC aperture cap is clogged.	
A: 024 WBC CLOG	The WBC aperture cap is clogged.	Press the Clean key to perform cleaning. Then recount the sample. If the alarm still occurs, perform strong cleaning, clean the aperture cap and replace the pump tube.
A: 025 WBC BUBBLE 1 A: 026 WBC BUBBLE 2 A: 027 WBC BUBBLE 3 A: 028 WBC BUBBLE 4	Air bubbles in WBC manometer.	Press the Clean key to perform cleaning. Then recount the sample.
A: 029 WBC PRIME ERROR	Insufficient diluent in the manometer or the connection tube is out of position.	Add the diluent or check that the connection tube is connected properly. Perform counting again after priming or cleaning the hematology analyzer.
A: 030 WBC NOISE 1 A: 031 WBC NOISE 2	Noise is detected during counting.	Check the grounding, and separate the instrument from other equipment and their power sources. Then recount the sample.
A: 032 WBC SAMPLE ERROR	Abnormal sample	Prepare the sample and measure again. Check that the temperature of the diluent is between 15 and 30°C.
A: 041 RBC LEVEL 1 A: 042 RBC LEVEL 2	Erroneous operation during counting.	Press the Clean key to perform cleaning. Then recount the sample. If the alarm still occurs, perform strong cleaning, clean the aperture cap and replace the pump tube.
A: 043 RBC LEVEL 3	The RBC aperture cap is clogged.	
A: 044 RBC CLOG	The RBC aperture cap is clogged.	Press the Clean key to perform cleaning. Then recount the sample. If the alarm still occurs, perform strong cleaning, clean the aperture cap and replace the pump tube.
A: 045 RBC BUBBLE 1 A: 046 RBC BUBBLE 2 A: 047 RBC BUBBLE 3 A: 048 RBC BUBBLE 4	Air bubbles in RBC manometer.	Press the Clean key to perform cleaning. Then recount the sample.
A: 049 RBC PRIME ERROR	Insufficient diluent in the manometer or the connection tube is out of position.	Add the diluent or check that the connection tube is connected properly. Perform counting again after priming or cleaning the hematology analyzer.
A: 050 RBC SAMPLE ERROR	Abnormal sample	Prepare the sample and measure again. Check that the temperature of the diluent is between 15 and 30°C.
A: 051 RBC NOISE 2 A: 052 PLT NOISE 1	Noise is detected during counting.	Check the grounding, and separate the instrument from other equipment and their power sources. Then recount the sample.
A: 060 UPPER MANO ERROR	The upper part of the manometer is dirty. Manometer sensor output is low.	Press the Clean key to perform the cleaning. Then press STRONG CLEAN on the OPERATION screen to perform the strong cleaning.
A: 061 LOWER MANO ERROR	The lower part of the manometer is dirty. Manometer sensor output is low.	

Error Messages	Possible Cause/Criteria	Countermeasure
A: 062 HGB VOLTAGE HIGH	HGB sensor output adjustment error.	- Adjust the HGB sensor output. Refer to "Adjusting HGB Sensor Output Voltage" in Section 5 "Adjustment". - Replace the CBC measuring unit with a new one if the internal connections have no problem and the message still appears after the adjustment.
A: 063 HGB CIRCUIT ERROR	Error in the HGB circuit.	Replace the CBC measuring unit with a new one if the internal connections have no problem and the message still appears after the adjustment.
A: 064 HGB VOLTAGE LOW	The WBC measurement bath is dirty or the CBC measuring unit has a failure.	- Check the HGB sensor output and adjust it after cleaning the measurement bath. Refer to "Adjusting HGB Sensor Output Voltage" in Section 5 "Adjustment". - Replace the CBC measuring unit with a new one if the internal connections have no problem and the message still appears after the adjustment.
A: 070 DOOR IS OPEN	The hematology analyzer does not operate because the door of the MS-721V cap pierce unit is open.	Close the door (tube holder).
A: 071 TUBE IS CONTAINED	Open mode can not be selected because the sample tube is set in the MS-721V cap pierce unit.	Remove the sample tube and close the door (tube holder).
A: 081 LASER OFF	The laser switch is not set to on.	To measure WBC 5 part differential parameters, set the laser switch on the right side panel to on with the laser key.
A: 090 ROOM TEMP OVER	Measurement is performed at temperatures over 30°C.	Perform measurement at temperatures between 15 and 30°C.
A: 091 ROOM TEMP LOW	Measurement is performed at temperatures below 15°C.	
A: 092 CASE TEMP OVER	Internal temperature, especially at the sheath unit, is abnormal.	- Turn off the hematology analyzer. After ventilating it, turn it on. Check the operation. - Replace the sheath unit with a new one if the message still appears after improving the ventilation.
A: 093 CASE TEMP LOW		
A: 094 POWER TEMP OVER	Internal temperature, especially at the power supply unit, is abnormal.	Turn off the hematology analyzer. After ventilating it, turn it on. Check the operation.
A: 101 WA-720VK ERROR	The thermal head of the built-in printer is not ready for printing.	- Set the head on the paper with the head set lever. - Replace the printer with a new one if the message still appears after setting the head on the paper.
A: 102 NO PAPER	There is no paper in the built-in printer.	Load the paper properly.
A: 103 WA-710V ERROR	The locally purchased external printer is not ready for printing.	Check the printer according to the instruction manual of the printer.
A: 104 NO PAPER	There is no paper in the locally purchased external printer.	Load the paper properly according to the instruction manual of the printer.

Error Messages	Possible Cause/Criteria	Countermeasure
WBC 5.0? RBC 4.50? (? is displayed on the right of measured value.)	Abnormal sample	Check that the temperature of the diluent is between 15 and 30°C. Then recount the sample. Water and alcohol cannot be measured.
HGB 13.4? (? is displayed on the right of HGB measured value.)	The WBC measurement bath is dirty.	Clean the measurement bath.
HGB 13.4* (* is displayed on the right of HGB measured value.)	HGB circuit error.	Needs measuring unit replacement. Contact your Nihon Kohden representative.
MCHC 38.0! (! is displayed on the right of MCHC measured value.)	Abnormal RBC. Error occurred when diluting the sample.	Check the hematology analyzer by counting the hematology control. Then recount the sample.
WBC 9.0! (! is displayed on the right of WBC measured value.)	WBC counting error. Poor hemolyzation.	
HGB 13.4! (! is displayed on the right of HGB measured value.)	HGB voltage adjustment error.	
WBC 9.0C PLT 490C (C is displayed on the right of WBC and PLT measured values.)	WBC and PLT counting error. Platelet coagulated. (Poor hemolyzation and low PLT)	
Replace filters	Measurement is performed more than 1000 times.	Replace the filters and reset the operation history.
Replace pump tubes	Measurement is performd more than 3000 times.	Replace the pump tubes and reset the operation history.
Check cap pierce needle	The measurement is performed more than 1000 times in closed mode when the MS-721V cap pierce unit is installed.	Check or replace the cap pierce needle and reset the operation history.

System Error Messages

System Error Message	Possible Cause/Criteria	Countermeasure
E: 001 DILUTER INITIALIZE ERROR	The diluter unit does not perform the initialization.	- Replace the diluter unit with a new one. - Replace the DRIVER board with a new one.
E: 002 BLOOD SAMPLING ERROR	The diluter unit does not aspirate a blood sample.	
E: 003 DILUTER ERROR		
E: 021 SAMPLER INITIALIZE ERROR	The sampler unit does not perform the initialization.	- Replace the sampler unit with a new one. - Replace the DRIVER board with a new one.
E: 022 SAMPLER ERROR	The sampler unit does not work.	
E: 041 WBC SUB BATH INITIALIZE ERROR	The WBC sub bath does not perform the initialization.	- Replace the CBC measuring unit with a new one. - Replace the DRIVER board with a new one.
E: 042 WBC SUB BATH ERROR	The WBC sub bath does not work.	
E: 051 RBC SUB BATH INITIALIZE ERROR	The RBC sub bath does not perform the initialization.	
E: 052 RBC SUB BATH ERROR	The RBC sub bath does not work.	
E: 081 TRIPLE PUMP INITIALIZE ERROR	The triple pump unit does not perform the initialization.	- Replace the triple pump unit with a new one. - Replace the DRIVER board with a new one.
E: 082 TRIPLE PUMP ERROR	The triple pump unit does not work.	
E: 101 WASTE PUMP1 ERROR	The pump unit does not drain the waste fluid from the measurement bath.	- Replace the pump unit with a new one. - Replace the DRIVER board with a new one.
E: 102 WASTE PUMP2 ERROR	The pump unit does not drain the waste fluid from the mixing chamber.	
E: 103 PRESSURE SENSOR ERROR	The output voltage from the pressure sensor on the SHEATH board is out of the acceptable range.	- Replace the SHEATH board with a new one. - Replace the sheath unit with a new one.
E: 121 A/D CIRCUIT ERROR	The A to D converter on the AMP CONTROL board has a failure.	Replace the AMP CONTROL board with a new one.
E: 122 CHECK SETTINGS	The backup data is inappropriately changed.	- Re-enter the calibration coefficient and all other settings. Then sample counting can be performed. - If the error still occurs, replace the back-up battery with a new one.
E: 123 MEMORY ERROR		
E: 124 CIRCUIT ERROR (CBC)	There is a circuit error in the CBC measuring unit or DRIVER board.	- Replace the CBC measuring unit with a new one. - Replace the DRIVER board with a new one.
E: 125 CIRCUIT ERROR (DIFF)	There is a circuit error on the AMP CONTROL board or DRIVER board.	- Replace the AMP CONTROL board with a new one. - Replace the DRIVER board with a new one.
E: 141 CAP PIERCE INITIALIZE ERROR	The cap pierce unit does not perform the initialization.	- Replace the cap pierce unit with a new one. - Replace the DRIVER board with a new one.
E: 142 CAP PIERCE RISING ERROR	The cap pierce unit does not perform the upward movement.	
E: 144 CAP PIERCE OPERATION ERROR	The cap pierce unit opens the tube holder door during measurement.	- Check that the blood sample tube is properly set in the tube holder. - Replace the cap pierce unit with a new one.
E: 145 TUBE HOLDER OPERATION ERROR	The cap pierce unit does not open the tube holder door when the Dispense/Open key is pressed before or after measurement.	- Check that a blood sample tube is properly set in the tube holder. - Replace the cap pierce unit with a new one.
E: 146 CAP PIERCE RINSING ERROR	The cap pierce unit does not move to the position of the rinse unit.	- Replace the cap pierce unit with a new one. - Replace the DRIVER board with a new one.

Inaccurate Counting and Other Problems

If operation is not accurate after attempting the countermeasure in the previous sections, check the causes according to the following table.

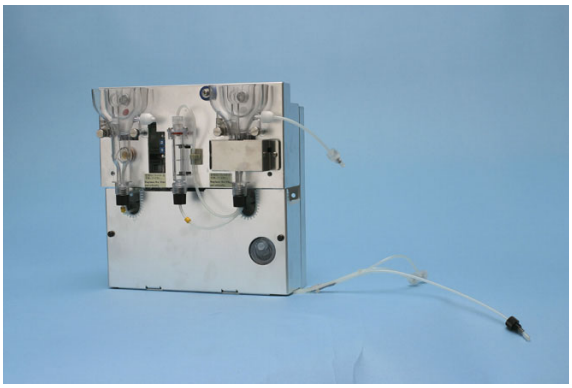
	Problem	Possible Cause/Criteria	Countermeasure
A	Noise interference during counting	Insufficient grounding.	Make sure the ground is sufficient.
		Equipment near the instrument is generating noise.	Separate the instrument from other equipment and their power sources.
		Noise in the power line.	Use a different power line.
		The front cover is open.	Close the front cover.
B	High background noise	Dirty diluent.	Replace the diluent.
		Dirty sub bath, measurement bath and filters.	Clean the sub bath, measurement bath and filters. Refer to Section 9.
		Dirty aperture caps.	Clean the aperture caps. Refer to Section 9.
		Poor contact of external electrode to the socket of the instrument.	Firmly tighten the measurement bath.
		The fluid path and diluent tube are dirty.	Press the Clean key to clean the fluid path using the CLEANAC detergent. Perform the strong cleaning by selecting STRONG CLEAN on the OPERATION screen.
C	Poor reproducibility of blood cell count	Insufficient stirring of sample.	Stir the sample sufficiently without creating bubbles.
		Dirty sub bath and/or measurement bath.	Clean the sub bath and/or measurement bath. Refer to Section 9.
		Dirty aperture caps.	Clean the aperture caps. Refer to Section 9.
		High background noise.	Reduce the background noise. Refer to Problem B.
D	Water leaks from inside the hematology analyzer	Pump tube is broken.	Replace the pump tube. Refer to Section 9.
		Filter is clogged.	Replace the filter. Refer to Section 9.
E	Poor reproducibility of HGB value	The WBC measurement bath is dirty.	Clean the measurement bath. Refer to Section 9.
F	Incorrect LCD display	Circuit error.	Press the Reset key. If the problem still occurs, turn off the instrument, wait about 10 seconds, then turn it on again.
	Instrument repeats same operation		
G	No printing	Paper jammed.	Remove the jammed paper. Refer to the printer manual.
		Circuit error.	Press the Reset key. If the problem still occurs, turn off the instrument, wait about 10 seconds, then turn it on again.
H	The touch screen keys do not function	The pressed position and operating position do not match.	Calibrate the touch screen. Refer to Section 9.
		Circuit error.	Press the Reset key. If the problem still occurs, turn off the instrument, wait about 10 seconds, then turn it on again.

	Problem	Possible Cause/Criteria	Countermeasure
I	Priming starts suddenly (When noise interferes with the instrument program, priming automatically starts and the READY screen appears.)	Power cord is not connected properly.	Connect the power cord properly.
		Equipment near the instrument is generating noise.	Separate the instrument from other equipment and their power sources.
		Noise in the power line.	Use a different power line.
J	The time displayed on the upper right corner of the screen is not correct.	The date and time setting is not correct.	Set the correct date and time setting on the DATE & TIME screen. Refer to Section 3.
		The backup battery is old.	Check the date and time setting on the DATE & TIME screen and turn off and on the power of the hematology analyzer. If the time is incorrect, replace the backup battery with a new one. Contact your Nihon Kohden distributor.
K	Scattergrams appear outside the alloted area.	Bubbles in the flow cell unit	Clean the flow cell unit. Refer to Section 9.
		Incorrect flow cell position	
	Flags related to WBC 5 part differential frequently appear.	Incorrect gain for WBC 5 part differential parameters	

Section 3 Board/Unit Description

CBC Measuring Unit 3.1
Diluter Unit 3.2
Pump Unit 3.2
Triple Pump Unit 3.3
Sampler Unit 3.3
Power Supply Unit and POWER Board 3.4
Inlet/Outlet Unit 3.4
Sheath Unit 3.5
Front Panel Unit 3.5
Optional Printer Unit WA-720VK 3.6
Rinse Unit and Switch Assembly 3.6
Laser Optical Unit 3.7
Flow Cell Adjuster 3.7
AMP CONTROL Board 3.7
DRIVER Board 3.8
Optional Cap Pierce Unit MS-721V 3.8

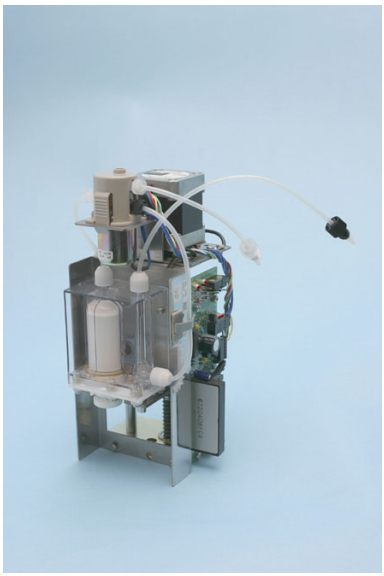
CBC Measuring Unit



The CBC measuring unit has two measurement baths and a common manometer. Each measurement bath has an aperture cap. The aperture size is different for the two baths (WBC and RBC/PLT). Two electrodes are positioned so that the aperture is in between them. A constant current flows between the two electrodes. When blood cells pass through the aperture, it causes electrical resistance and the voltage between the two electrodes varies in proportion to the cell size. These voltage pulses for each cell are obtained until a constant volume of diluted sample is aspirated. For more details about counting method and hydraulic operation, refer to “Electric Cell Counting” and “Principle of Hydraulic Operation” in Section 10 “Reference” of the operator’s manual.

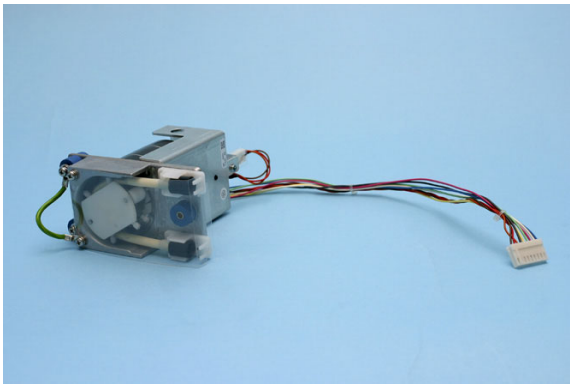
After the chemical processing is applied to the blood sample, the CBC measuring unit measures the hemoglobin concentration when a specific wavelength light (540 nm) is transmitted through the blood sample and diluent to the HGB sensor. The light intensity passed through the blood sample is inversely proportional to the hemoglobin concentration. The light intensity passed through diluent is used as reference. The HGB sensor converts the light intensity to current. A voltage is obtained from the current. For more details about chemical processing, refer to “Hemoglobin Measurement” in Section 10 “Reference” of the operator’s manual.

Diluter Unit



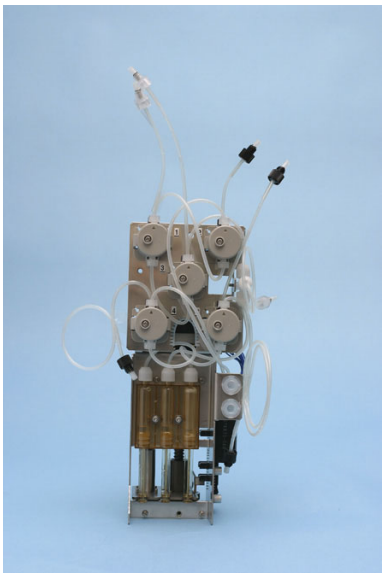
The diluter unit aspirates a whole blood sample and dilutes it 200 times for WBC/HGB and 40,000 times (200 x 200) for RBC/PLT with diluent. The diluter unit supplies diluent to all the fluid paths.

Pump Unit



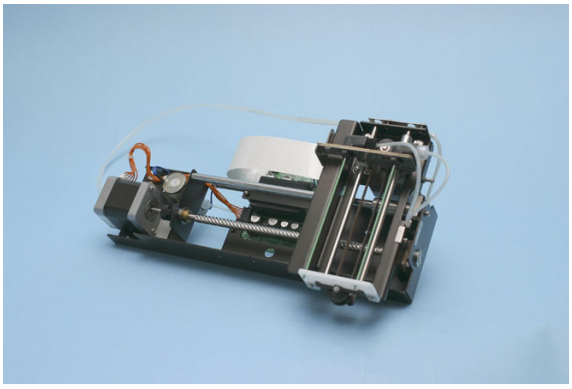
There are two pump units. One is used for counting the blood cells and measuring the hemoglobin. The other is used for WBC 5-part differential measurement.
The pump unit generates pressure to aspirate the blood sample and drain the waste fluid.

Triple Pump Unit



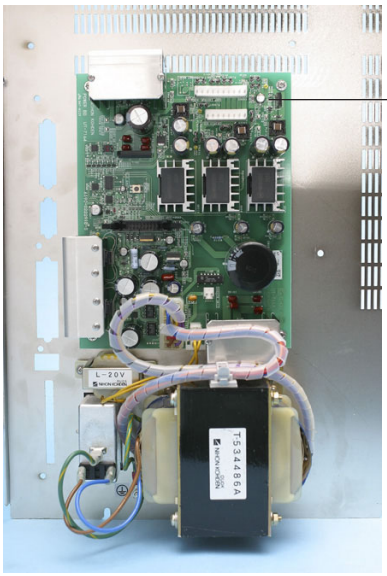
The triple pump unit aspirates a constant volume of diluent or one of two types of the hemolysing reagents and dispenses the diluent or hemolysing reagent to the specified fluid path.

Sampler Unit



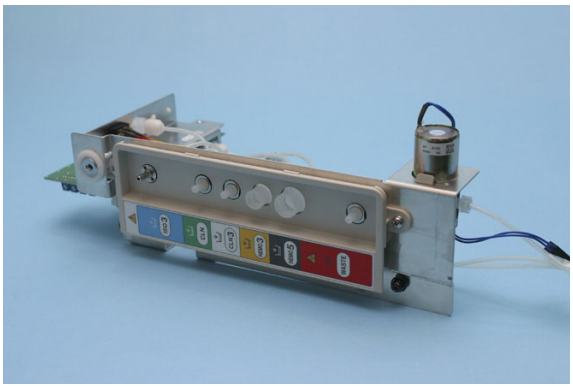
The sampler unit aspirates a whole blood sample with the WBC sampling nozzle, moves it to the sub bath of the WBC measurement bath, and dispenses the aspirated sample and diluent (from the diluter unit) to the sub bath so that the sample is diluted 200 times in the sub bath. The sampler unit aspirates the 200 times diluted sample with the RBC sampling nozzle, moves it to the sub bath of the RBC measurement bath, and dispenses the 200 times diluted sample and diluent (from the diluter unit) to the sub bath so that the sample is diluted 40,000 times in the sub bath.

Power Supply Unit and POWER board



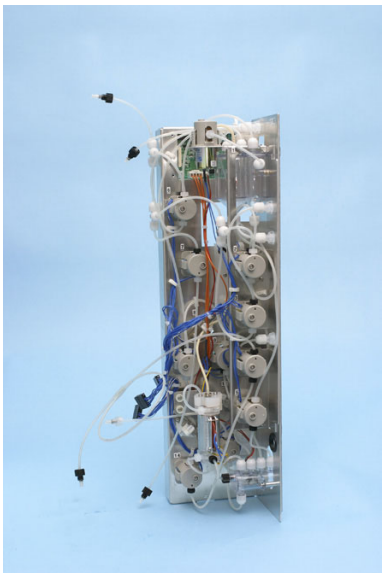
The power supply unit has a power transformer and AC inlet socket with main power switch and two fuses. The power supply unit transforms the AC line voltage to AC voltages. The POWER board converts the AC voltages to the DC supply voltages for the boards, motors and valves.

Inlet/Outlet Unit



The inlet/outlet unit detects the diluent, detergent and two different hemolysing reagents. These fluids are supplied to the specified fluid path through this unit. All waste fluids are drained through this unit.

Sheath Unit



The sheath unit produces a specific sample for WBC 5-part differential measurement. The sample is mixed with the hemolysing reagent and injected into the center of the flow cell. The pressurized diluent is injected into the sheath of the flow cell.

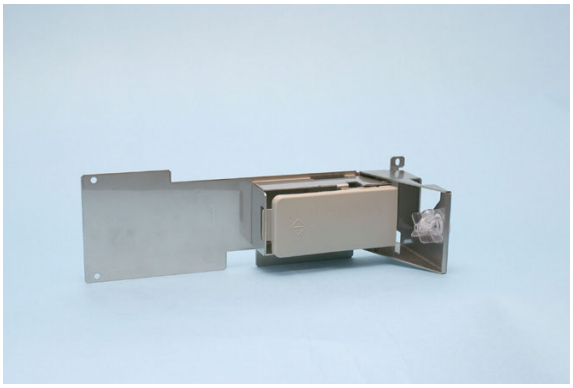
Front Panel Unit

The front panel unit consists of the KEY DISPLAY board and VOLUME board. The KEY DISPLAY board has key switches such as Power key and Dispense/Open key, and LED lamps such as power lamp and operation indicator lamps. The numeric, graphic and message data are processed on this board to display them on the LCD. The touch screen communicates with this board. The VOLUME board has a variable resistor for contrast control. This front unit has a space for the optional WA-720VK printer unit.

Optional Printer Unit WA-720VK

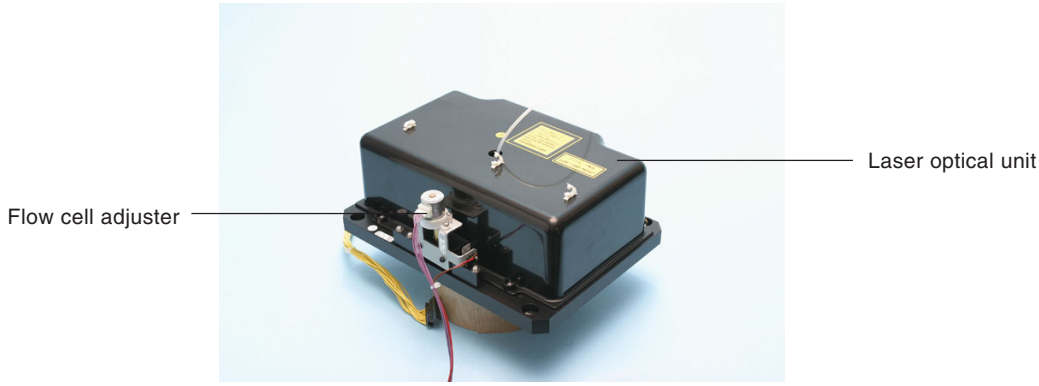
The printer unit is installed into the front unit. The pinter unit prints the numeric data, scattergrams and histograms on thermal roll paper.

Rinse Unit and Switch Assembly



The rinse unit cleans the sampling nozzle that blood clots can build up on the surface. The count switch is included in this assembly.

Laser Optical Unit

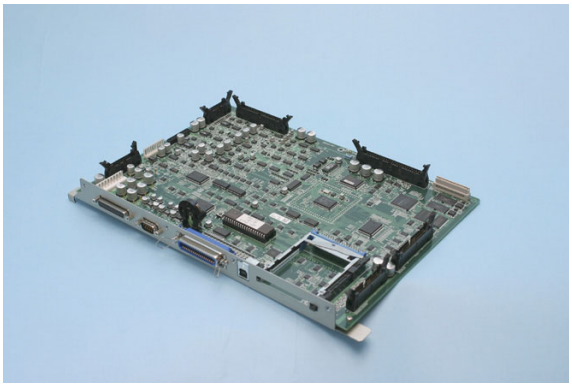


The laser optical unit consists of optical components such as the laser diode and flow cell. To differentiate WBC into 5 parts, a light scatter technique (flow cytometry with laser) is used. The laser optical unit detects the light scattered by the hemolyzed cells which pass in single file. The scattered light is converted to electrical signals.

Flow Cell Adjuster

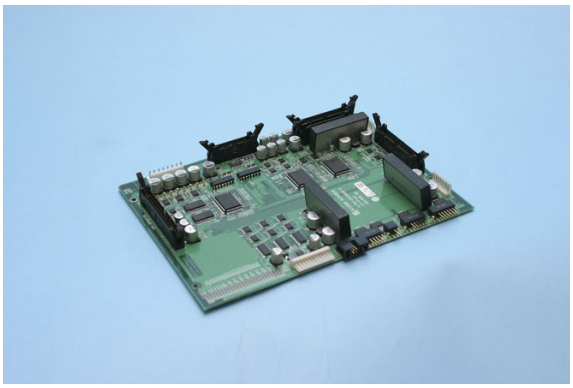
The flow cell adjuster adjusts the position of the flow cell in the laser optical unit with a stepping motor.

AMP CONTROL Board



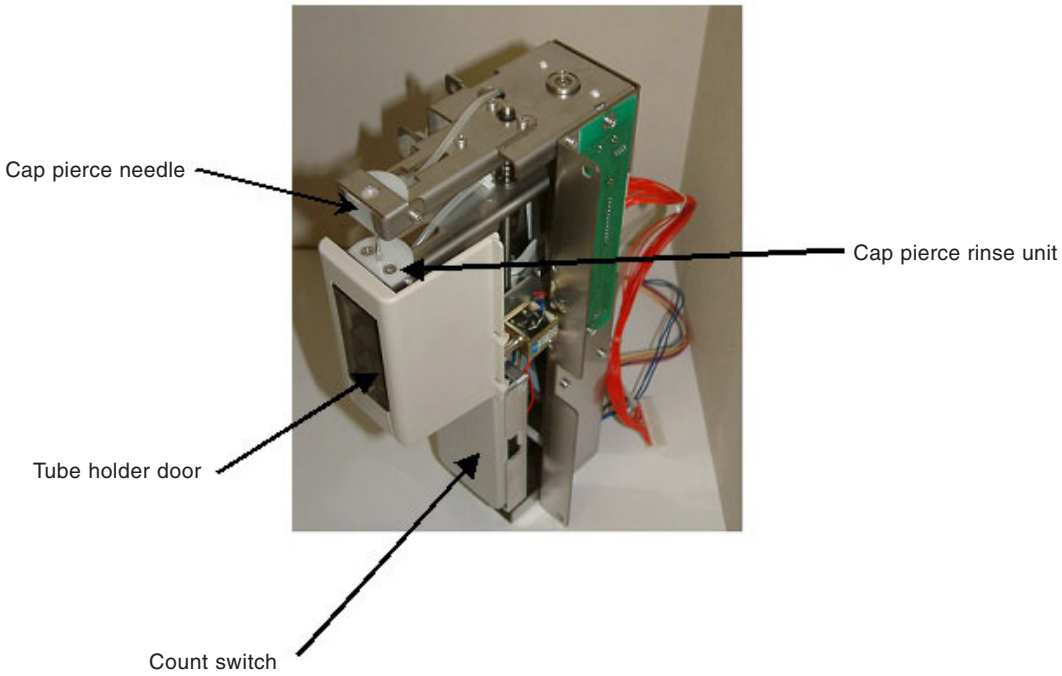
The AMP CONTROL board controls operations such as measurement and cleaning the fluid path. This board amplifies the analog signals which are output from the CBC measuring unit, converts the analog signals to digital signals, receives the signals from the switches and sensors, and sends the control data to the DRIVER board so that the valves and motors are optimally controlled.

DRIVER Board



The DRIVER board receives the control data from the AMP CONTROL board and drives the valves and motors by setting the drive current to on or off.

Optional Cap Pierce Unit MS-721V



The cap pierce unit allows you to get the measurement data without opening the cap of the sample tube and touching the blood.

Section 4 Disassembly and Assembly

Before You Begin 4.1
- Warnings and Cautions 4.1
- Required Tools 4.1
- Caution and Notes Related to Valve Joint, Black Screw and Tube Joint in the Instrument 4.2

Board and Unit Location 4.3
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- lest Side 4.3
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Opening the Front Cover 4.7
Removing the Top Cover 4.8
Replacing the Boot ROM 4.9
Removing the Rear Cover Including the Power Supply Unit 4.11
Removing the CBC Measuring Unit 4.12
Removing the Diluter Unit 4.13
Removing the Sampler Unit 4.15
Removing the Pump Unit 4.16
Removing the Triple Pump Unit 4.18
Removing the WA-720VK Printer Unit (Option) 4.19
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Removing the Flow Cell Adjuster 4.24
Removing the Laser Optical Unit 4.26
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Removing the Rinse Unit and Switch Assembly 4.31
Replacing the AMP CONTROL Board 4.32
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Replacing the VOLUME Board, KEY DISPLAY Board and LCD Unit 4.34
Replacing the MS-721V Cap Pierce Unit (Option) 4.36

The procedures in this section tell how to remove, replace and install major components in the instrument.

Before You Begin

Removing, replacing and installing major components should be done by qualified service personnel.

Warnings and Cautions

WARNINGS

- **To avoid the possibility of injury to yourself or damage to the instrument, do not install or remove any component or change switch settings while the power is on and wait 10 minutes before installing to or removing any component from the instrument after the power is off.**
- **To avoid accidental discharge of static electricity which could damage the instrument components, use a wrist ground strap when installing or removing any component of the instrument.**
- **When replacing any parts or units in the instrument, do not touch the site of the instrument where blood is or may be.**
- **Wear rubber gloves to prevent infection by blood.**

CAUTIONS

- **Before connecting or disconnecting any cables, turn off the instrument and unplug the AC power cord from the instrument.**
- **Fuses cut off the power when an abnormality occurs in the instrument. Eliminate the malfunction before replacing the fuse. Use the correct fuse only. The fuse rating is shown on the holder.**
- **Removal and replacement of any component in the instrument should be done by qualified service personnel.**
- **Use only parts recommended by Nihon Kohden to assure maximum performance from your instrument.**

Required Tools

- Anti-static bench mat
- Wrist ground strap
- Phillips screwdriver (insulated type)
- Flat-blade screwdriver (insulated type)
- Tweezers

Caution and Notes Related to Valve Joint, Black Screw and Tube Joint in the Instrument

CAUTION

Valve Joint

When connecting the valve joint to the electromagnetic valve, turn the valve joint clockwise, using moderate force until the valve joint comes to a stop. Do not use extreme force to tighten the valve joint further because this will damage the tip of the valve joint. If the valve joint is loosely connected, it will leak.

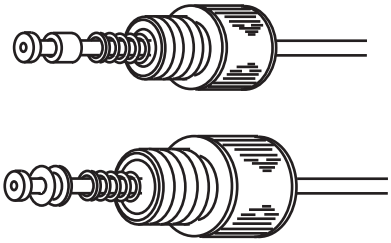
NOTE

Black screw

Black screws are used to fasten the individual units to the chassis of the instrument to enable the quick removal and replacement of these units. However, to fasten the pump unit to the chassis, normal screws are used.

Spring type tube joint

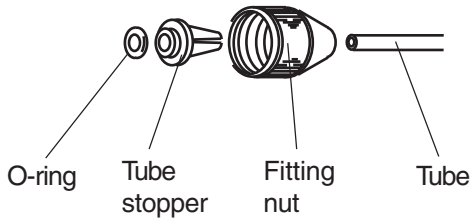
- **Spring type tube joints are used in the instrument to prevent over-tightening of the joints, and to prevent loosening of the joints after the joints are tightened.**



- **There are 2 types of spring tube joints, white (inlet side) and black (outlet side). Each tube joint and its corresponding port in the instrument are marked with the same color or number to ensure matching.**

No spring type tube joint

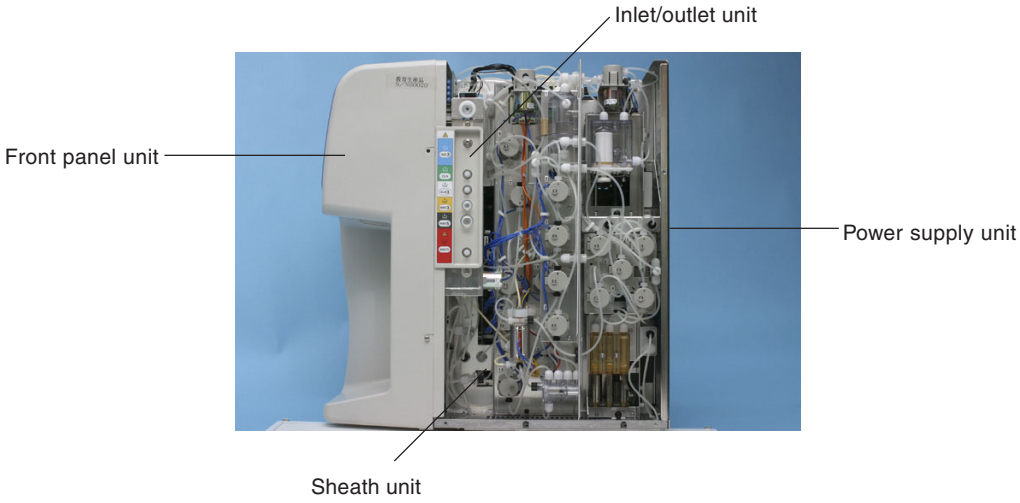
The no spring type tube joint consists of the O-ring, tube stopper and fitting nut. To disconnect the tube from this joint, turn the fitting nut counterclockwise to loosen the joint and pull the tube toward you. To reconnect the tube to this joint, insert the tube into the fitting nut and turn the fitting nut clockwise to fasten it.



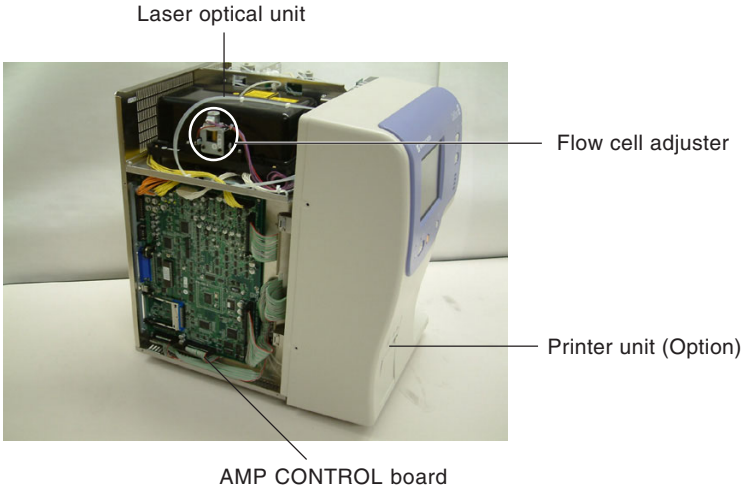
Board and Unit Location

This following pictures show the location of the boards and units in the hematology analyzer.

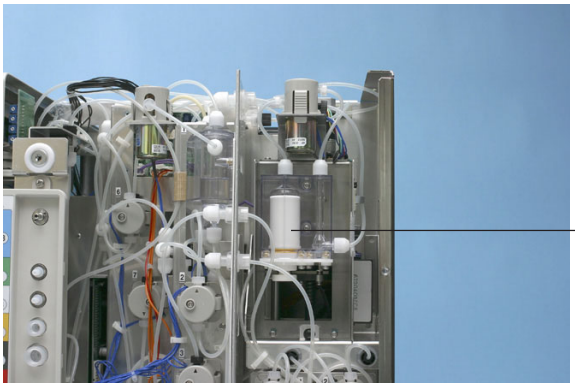
Right Side



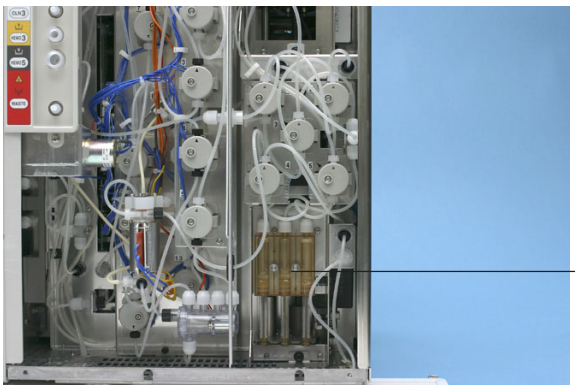
Left Side



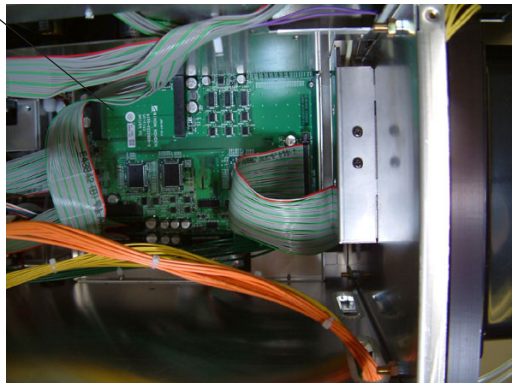
Upper Part of Right Side



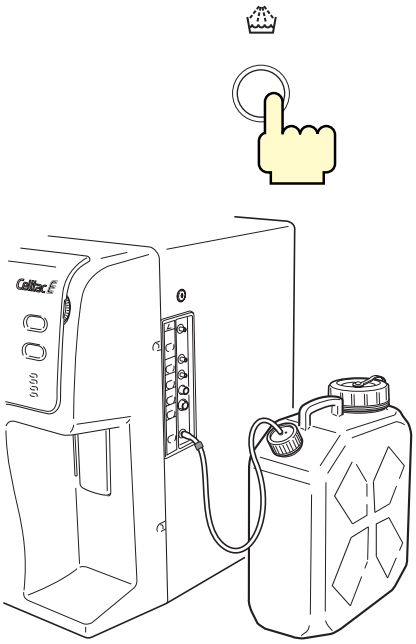
Lower Part of Right Side



Front View of Chassis



Draining the Hematology Analyzer



To avoid any trouble, drain all the fluid from the hematology analyzer. Some of the units described in this section require the following procedure.

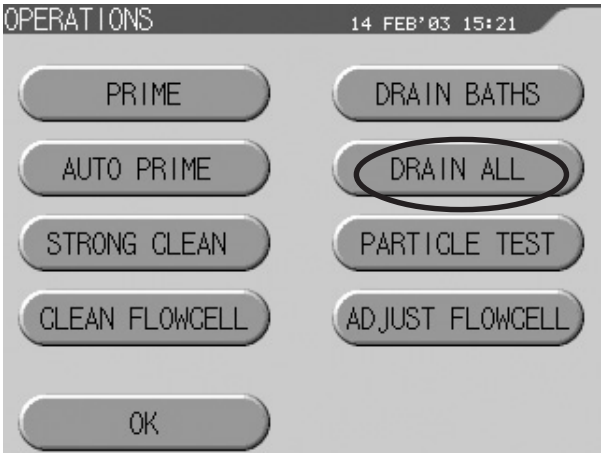
1. Press the STRONG CLEAN key on the OPERATIONS screen to perform strong cleaning.

2. Disconnect the diluent tube from the ISO3 inlet, the hemolysing reagent tubes from the HEMO3 and HEMO5 inlets, and the detergent tubes from the CLN and CLN3 inlets on the right side panel.

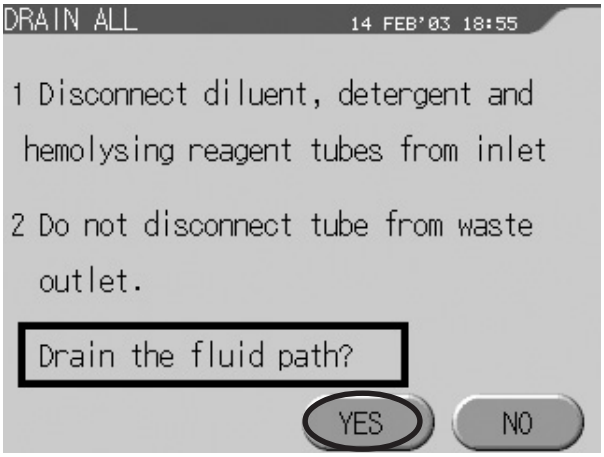
CAUTION

Do not disconnect the waste fluid tube from the WASTE outlet.

3. Press the DRAIN ALL key on the OPERATIONS screen.

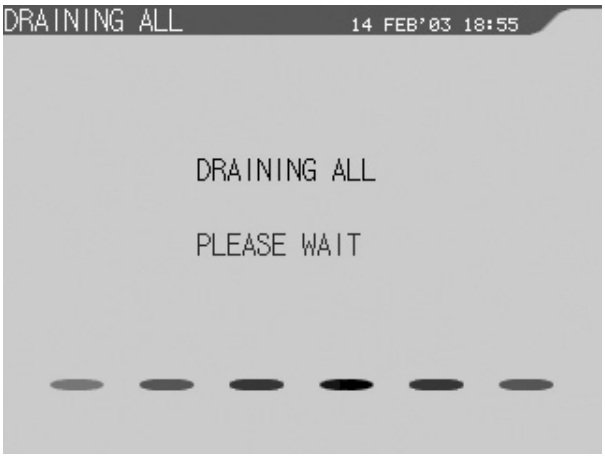


A confirmation messages appears on the screen.


DRAIN ALL
14 FEB'03 18:55
1 Disconnect diluent, detergent and hemolysing reagent tubes from inlet
2 Do not disconnect tube from waste outlet.
Drain the fluid path?
YES
NO

4. Press YES to start draining. If you press NO, the process is canceled and the screen returns to the READY screen.

During draining, the screen shows the “DRAINING ALL” message.



When draining is completed, the “PRESS [CLEAN] KEY” message appears.

5. Press the main power switch on the rear panel to turn the power off. The power lamp and main power lamp go off.

WARNING

For you safety, before disassembling the hematology analyzer, wait approx. 10 minutes after turning off the main power switch.

Opening the Front Cover

1. Press the main power switch on the rear panel to turn the power off. The power lamp and main power lamp go off.

WARNING

For your safety, before disassembling the hematolozy analyzer, wait approx. 10 minutes after turning off the main power switch.

2. Remove the 4 screws which secure the front cover to the hematology analyzer chassis.

3. Slightly pull the front cover toward you and open it as shown below.

To assemble the hematology analyzer, reverse the above procedure.

Removing the Top Cover

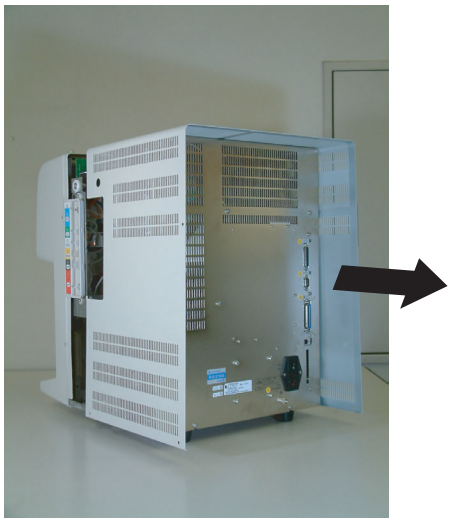
1. Press the main power switch on the rear panel to turn the power off. The power lamp and main power lamp go off.

WARNING

For your safety, before disassembling the hematolozy analyzer, wait approx. 10 minutes after turning off the main power switch.

2. Remove the 6 screws which secure the top cover to the hematology analyzer chassis at the right and left side.

3. Slide the top cover rearward and remove it from the chassis.



To assemble the hematology analyzer, reverse the above procedure.

NOTE in Assembling the Hematology Analyzer

There are hooks at the top, right and left inside of the top cover. Fit these hooks into the front cover edge.

Replacing the Boot ROM

CAUTION

The ROM is easily damaged by static electricity. Before touching the ROM, touch the metal chassis to eliminate static electricity from your body.

1. If there are different settings from the default settings on the CALIBRATION and SETTINGS screens, write down these settings.
2. Press the main power switch on the rear panel to turn the power off. The power lamp and main power lamp go off.

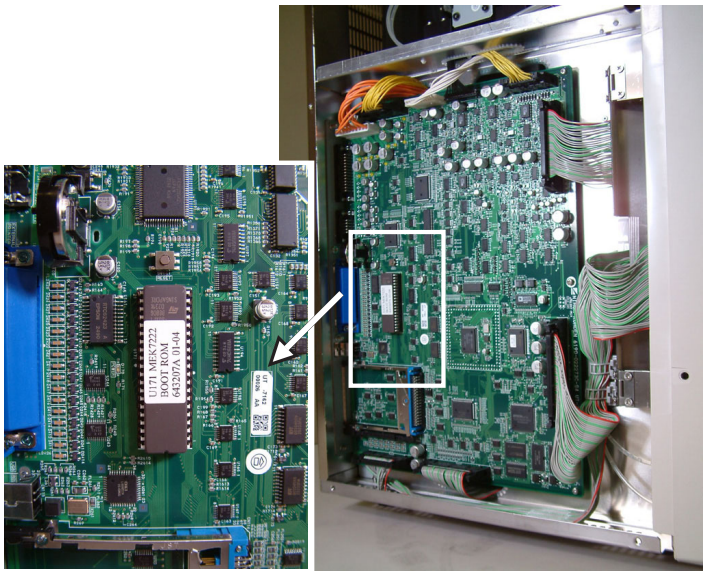
WARNING

For your sefety, before disassembling the hematolozy analyzer, wait approx. 10 minutes after turning off the main power switch.

3. Remove the top cover according to the procedure described in “Removing the Top Cover”.
4. Insert a small flat-blade screwdriver between the ROM and its socket on the AMP CONTROL board. Carefully lift the ROM with the screwdriver until the ROM slightly tilts. Take out the screwdriver and insert it into the oppisite side of the IC socket. Continue lifting both sides of the ROM with the screwdriver until the ROM is removed.

CAUTION

When you remove the ROM from the IC socket with a sharp edge tool such as a flat-blade screwdriver, be sure that it does not damage the printed pattern under the IC socket.



5. Put the new ROM on the IC socket and carefully insert the pins of the new ROM into the IC socket.

CAUTION

- **Before putting the new ROM on the IC socket, check that the ROM position is correct as shown in step 4.**
- **Do not break or bend a pin of the ROM. The pins must be correctly inserted into the socket. Otherwise the hematology analyzer may not work.**

6. Put the top cover back to the original position. Refer to “Removing the Top Cover”.
7. Turn on the main power switch on the rear panel.
8. Continue pressing the Reset key, Clean key and Dispense/Open key on the front panel, press the Power key on the panel, release the Power key, and release the Reset key, Clean key and Dispense/Open key.
9. While pressing the Reset key, press the Capillary blood mode key on the front panel. The TOUCH SCREEN CALIBRATION screen appears. Adjust the touch screen properly. Refer to "Calibrating Touch Screen" in Section 9 "Maintenance" of the operator's manual.
10. Initialize the settings according to “Initializing Settings” in Section 3 “Changing Settings” of the operator’s manual.
11. Enter the settings which you wrote down in step 1.

Removing the Rear Cover Including the Power Supply Unit

1. Press the main power switch on the rear panel to turn the power off. The power lamp and main power lamp go off.

WARNING

For your sefety, before disassembling the hematolozy analyzer, wait approx. 10 minutes after turning off the main power switch.

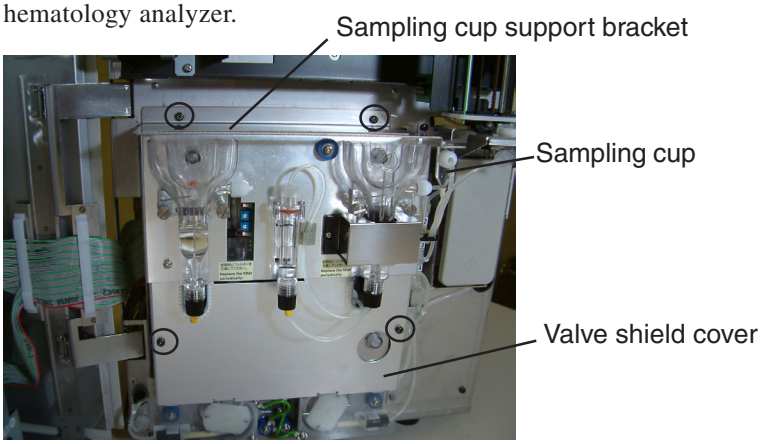
2. Remove the top cover according to the procedure described in “Removing the Top Cover”.
3. Loosen the 2 screws at the bottom of the rear cover.

4. Remove the 7 screws which secure the rear cover to the hematology analyzer chassis.
5. Pull the rear cover including the power supply unit upward. Carefully separate the rear cover from the hematology analyzer chassis and disconnect the 4 cables at the POWER board. Completely remove the rear cover from the chassis.

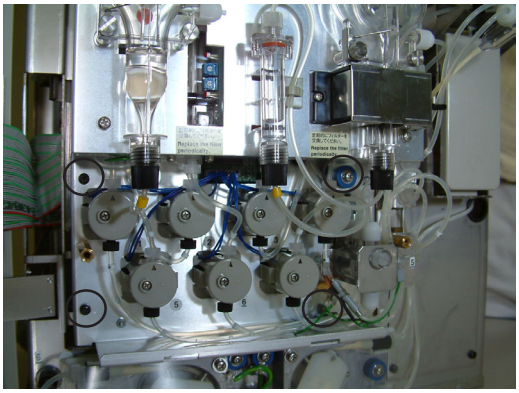
To assemble the hematology analyzer, reverse the above procedure.

Removing the CBC Measuring Unit

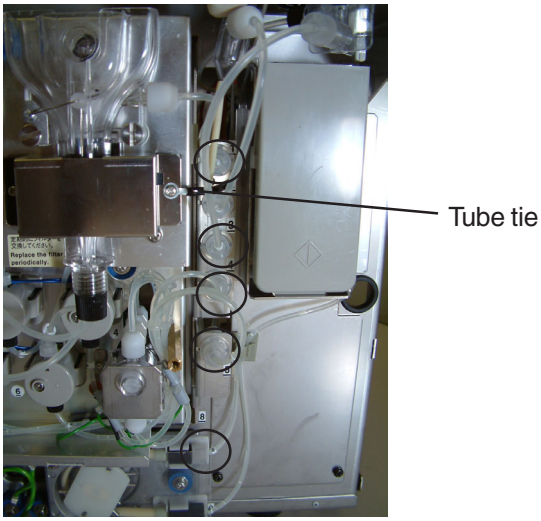
1. Drain all the fluid from the hematology analyzer according to the procedure described in “Draining the Hematolozy Analyzer”.
2. Open the front cover according to the procedure described in “Opening the Front Cover”.
3. Remove the 4 black screws which secure the valve shield cover and sampling cup support bracket including the sampling cup. Remove them from the hematology analyzer.



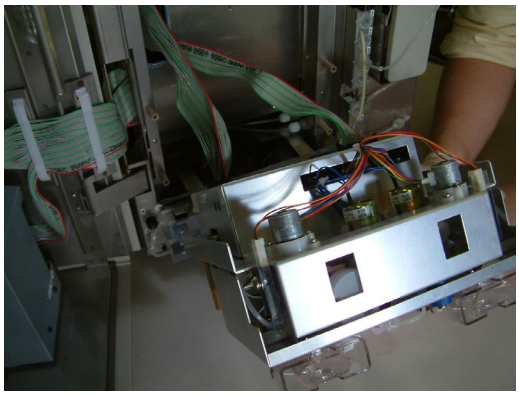
4. Remove the 4 screws which secure the CBC measuring unit to the hematology analyzer chassis.



5. Release the tube tie which binds the tubes.



6. Disconnect the No. 1, No. 3, No. 4, No. 5 and No. 8 tube joints.
7. Disconnect the 2 flat cables from the CBC measuring unit.

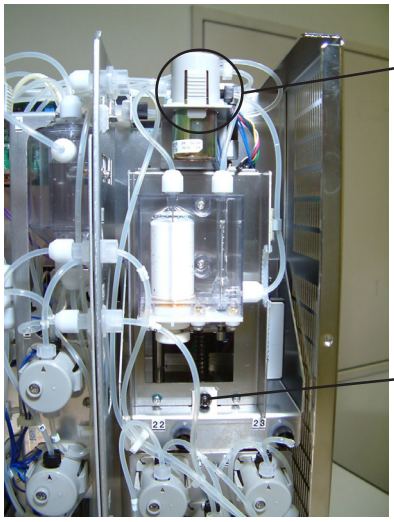


8. Remove the CBC measuring unit from the chassis completely.

To assemble the hematology analyzer, reverse the above procedure.

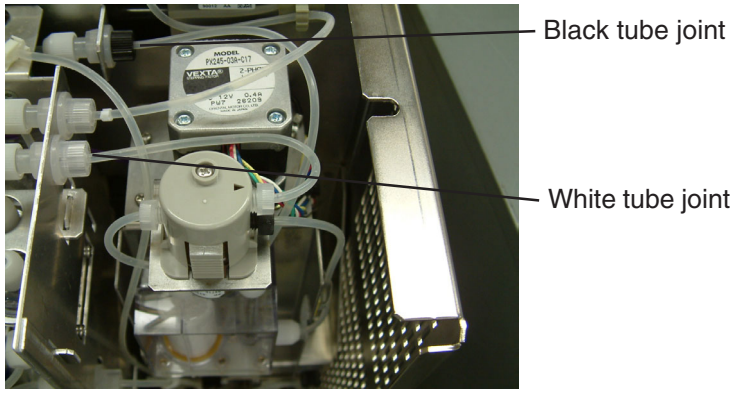
Removing the Diluter Unit

1. Drain all the fluid from the hematology analyzer according to the procedure described in “Draining the Hematolozy Analyzer”.
2. Remove the top cover according to the procedure described in “Removing the Top Cover”.
3. Remove the black screw which secures the lower part of the diluter unit.

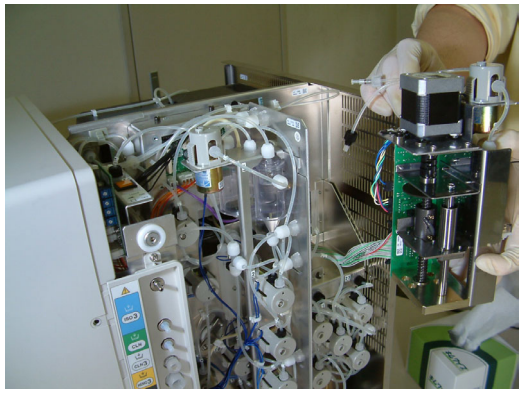


4. Remove the black screw which secures the upper part of the diluter unit.

5. Disconnect the white tube joint and black tube joint from the diluter unit.



6. Pull the diluter unit upward. Carefully separate it from the hematology analyzer chassis and disconnect the cable from the diluter unit. Completely remove the diluter unit from the chassis.



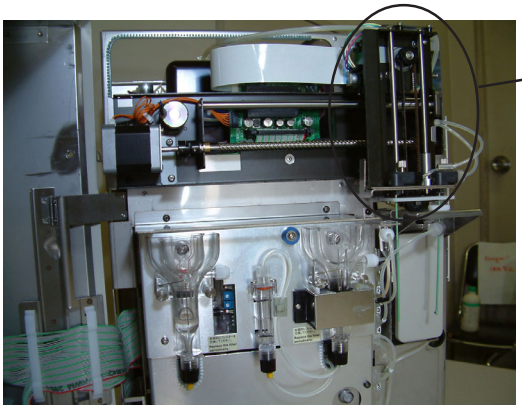
To assemble the hematology analyzer, reverse the above procedure.

CAUTION in Assembling the Hematology Analyzer

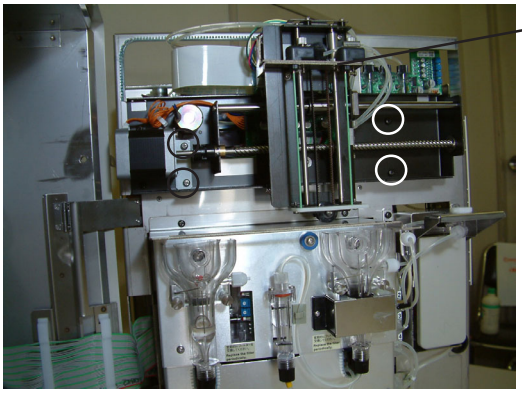
Check that all the tube joints are firmly connected to the original positions. Otherwise, fluid may leak.

Removing the Sampler Unit

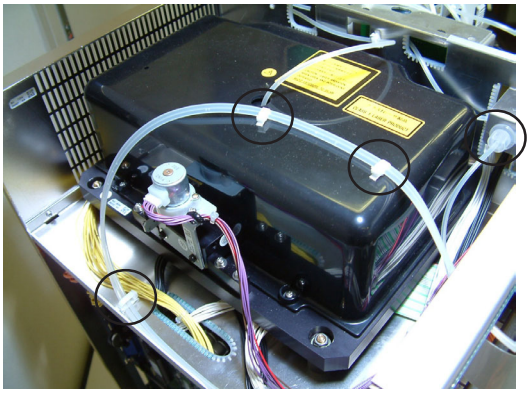
1. Drain all the fluid from the hematology analyzer according to the procedure described in “Draining the Hematolozy Analyzer”.
2. Open the front cover according to the procedure described in “Opening the Front Cover”.
3. Remove the top cover according to the procedure described in “Removing the Top Cover”.



4. Move the sampling nozzle support plate upward and move the nozzle mover leftward as shown below so that you can remove the 4 screws which secure the sampler unit to the chassis.

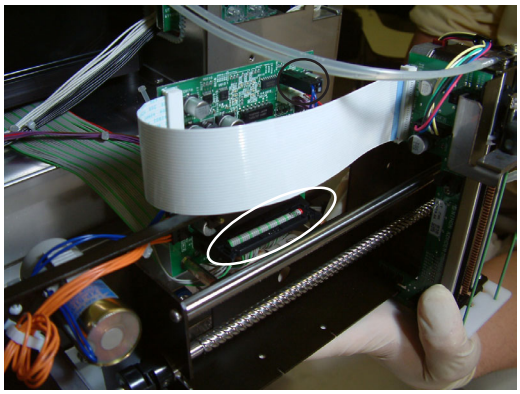


5. Remove the 4 screws which secure the sampler unit to the chassis.
6. Release the 3 tube ties and remove the tube joint as shown below.



7. Pull the sampler unit upward until the hooks at both sides are released. Pull the sampler unit toward you.

8. Disconnect the 2 cables from the sampler unit.



9. Completely remove the sampler unit from the chassis.

To assemble the hematology analyzer, reverse the above procedure.

CAUTION in Assembling the Hematology Analyzer

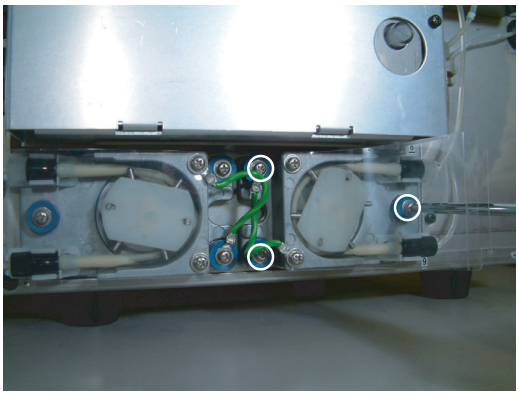
Check that all the tube joints are firmly connected to the original positions. Otherwise, fluid may leak.

Removing the Pump Unit

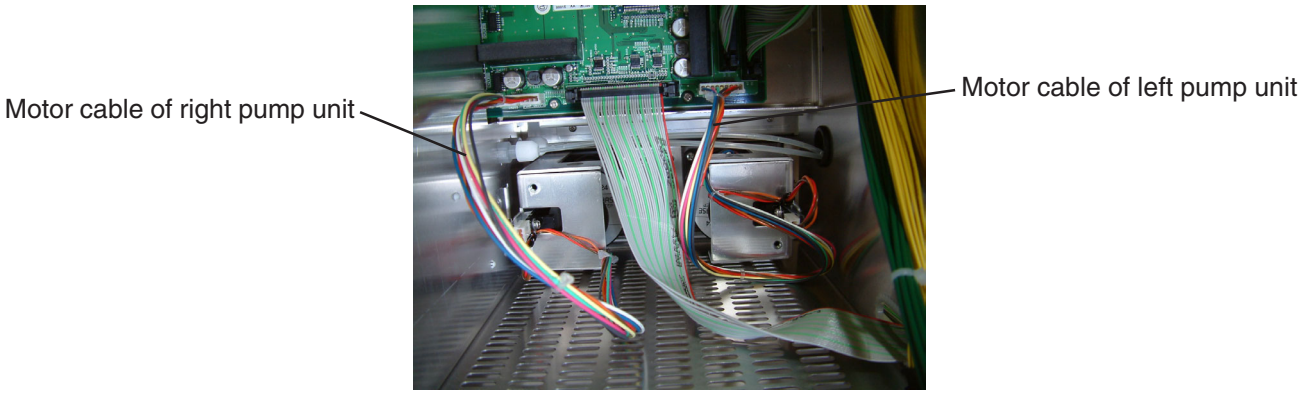
There are two pump units at the front of the hematology analyzer chassis. To remove one of the pump units, perform the following procedure.

1. Drain all the fluid from the hematology analyzer according to the procedure described in “Draining the Hematolozy Analyzer”.
2. Open the front cover according to the procedure described in “Opening the Front Cover”.
3. Remove the rear cover including the power supply unit according to the procedure described in “Removing the Rear Cover Including the Power Supply Unit”.

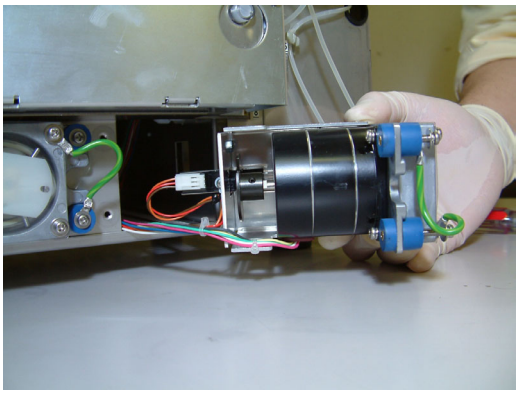
4. Remove the 3 screws which secure the pump unit to the chassis. (The following picture shows the right pump unit about to be removed.)



5. Disconnect the motor cable of the pump unit at the DRIVER board on the rear cover.



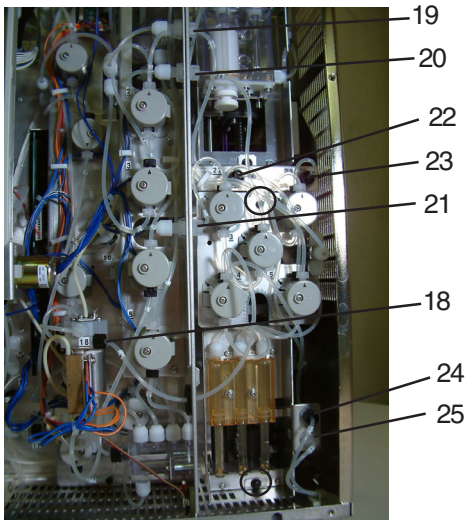
6. Pull the pump unit frontward and remove the pump unit from the chassis.



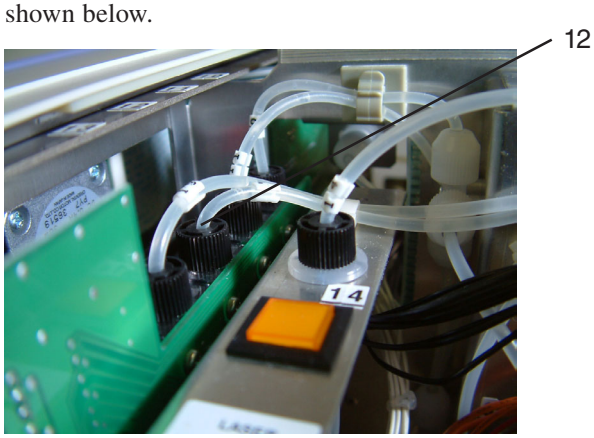
To assemble the hematology analyzer, reverse the above procedure.

Removing the Triple Pump Unit

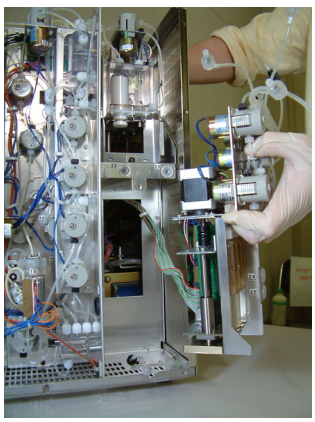
1. Drain all the fluid from the hematology analyzer according to the procedure described in “Draining the Hematolozy Analyzer”.
2. Remove the top cover according to the procedure described in “Removing the Top Cover”.
3. Disconnect the 8 tube joints (No. 18 to No. 25).



4. Remove the 2 black screws which secure the triple pump unit to the chassis.
5. Disconnect the black tube joint (No. 12) connected to the inlet/outlet unit as shown below.



6. Carefully pull the triple pump unit frontward. Disconnect the cable from the triple pump unit. Remove the triple pump unit from the chassis.



To assemble the hematology analyzer, reverse the above procedure.

Removing the WA-720VK Printer Unit (Option)

1. Press the main power switch on the rear panel to turn the power off. The power lamp and main power lamp go off.

WARNING

For your sefety, before disassembling the hematolozy analyzer, wait approx. 10 minutes after turning off the main power switch.

2. Open the front cover according to the procedure described in “Opening the Front Cover”.
3. Release the 2 cable ties which bind the flat cable of the printer unit.

4. Remove the 4 screws which secure the printer unit to the front cover.

5. Disconnect the flat cable from the printer unit as shown below.

6. Completely remove the printer unit from the front cover.

To assemble the hematology analyzer, reverse the above procedure.

Removing the Front Panel Unit

1. Press the main power switch on the rear panel to turn the power off. The power lamp and main power lamp go off.

WARNING

For your sefety, before disassembling the hematolozy analyzer, wait approx. 10 minutes after turning off the main power switch.

2. Open the front cover according to the procedure described in “Opening the Front Cover”.
3. Remove the top cover according to the procedure described in “Removing the Top Cover”.
4. Remove the 4 screws which secure the front panel unit to the chassis through the 2 hinges.

CAUTION

Hold the front panel unit immediately after removing the 4 screws. Otherwise, the front panel unit can fall down and be damaged due to its weight.

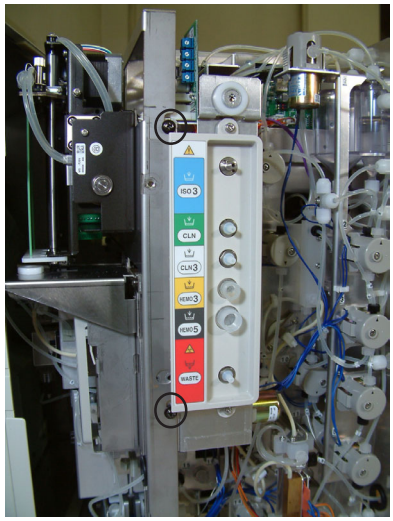
5. Release the cable tie and disconnect the cable from the front panel unit as shown below.

6. Completely remove the front panel unit from the chassis.

To assemble the hematology analyzer, reverse the above procedure.

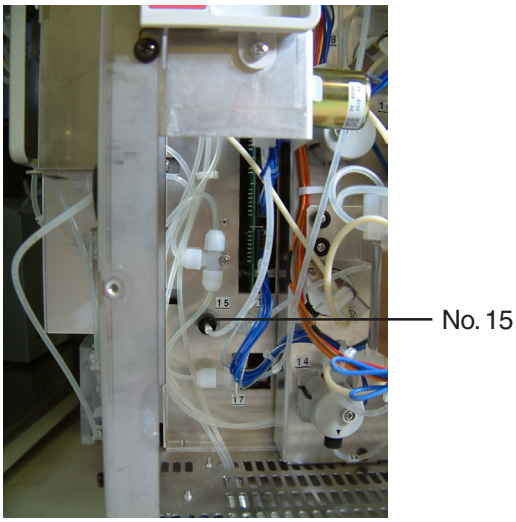
Removing the Inlet/Outlet Unit

1. Drain all the fluid from the hematology analyzer according to the procedure described in “Draining the Hematolozy Analyzer”.
2. Open the front cover according to the procedure described in “Opening the Front Cover”.
3. Remove the top cover according to the procedure described in “Removing the Top Cover”.
4. Loosen the 2 black screws which secure the inlet/outlet unit to the chassis.

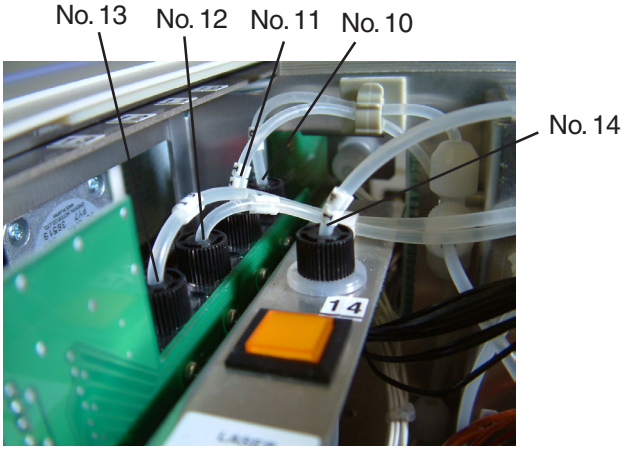


5. Release the tube tie as shown below and disconnect the No. 9 tube joint.

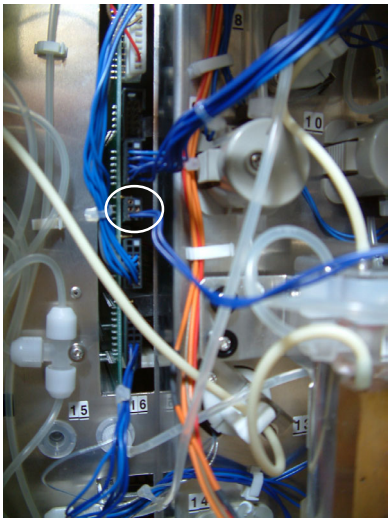
6. Disconnect the No. 15 tube joint as shown below.



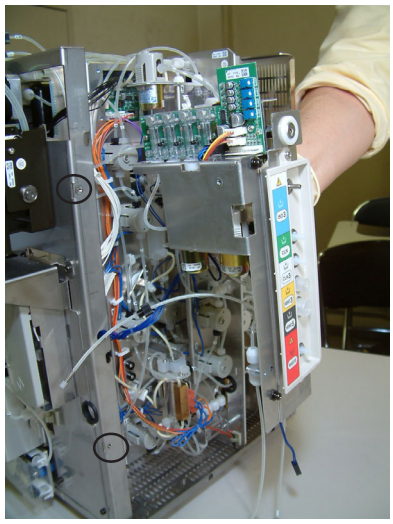
7. Disconnect the 5 tube joints (No. 10 to No. 14).



8. Disconnect the cable from the inlet/outlet unit as shown below.



9. Slightly pull the inlet/outlet unit upward and move it rightward. Completely remove the inlet/outlet unit.



To assemble the hematology analyzer, reverse the above procedure.

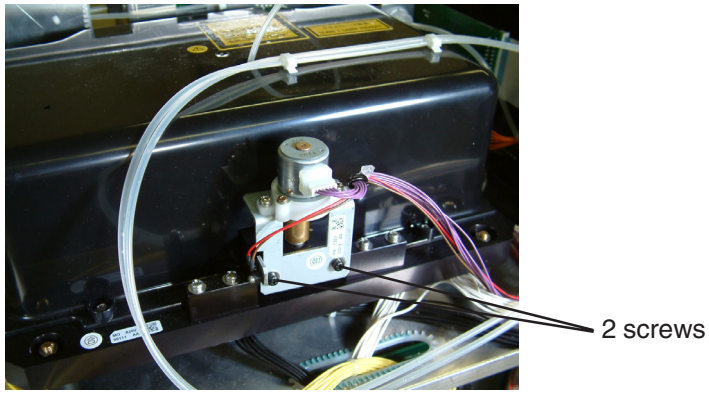
Removing the Flow Cell Adjuster

1. Press the main power switch on the rear panel to turn the power off. The power lamp and main power lamp go off.

WARNING

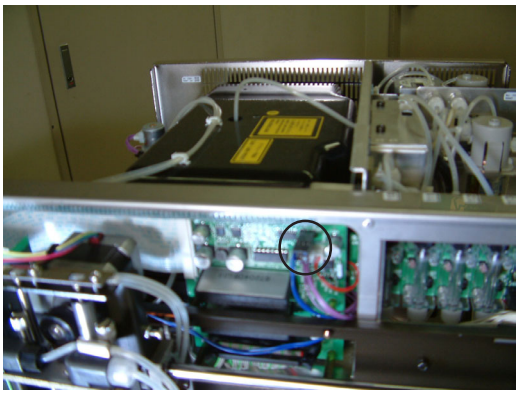
For your sefety, before disassembling the hematolozy analyzer, wait approx. 10 minutes after turning off the main power switch.

2. Open the front cover according to the procedure described in “Opening the Front Cover”.
3. Remove the top cover according to the procedure described in “Removing the Top Cover”.
4. Remove the 2 black screws which secure the flow cell adjuster to the chassis.

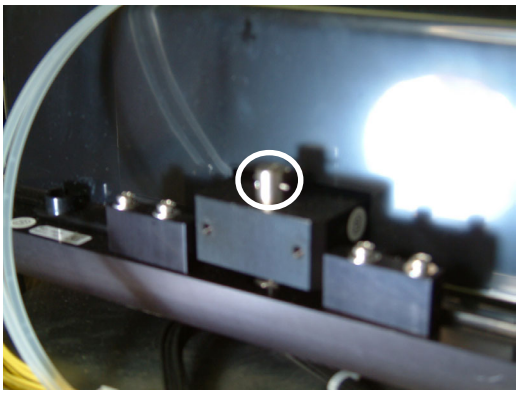


5. Gently pull the flow cell adjuster upper part upward and separate it from the laser optical unit.

6. Disconnect the flow cell adjuster cable at the sampler unit.



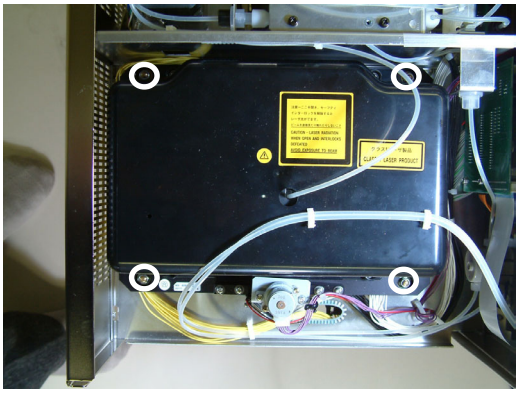
7. Remove the adjuster pin from the flow cell unit. Refer to “Removing the Laser Optical Unit”.



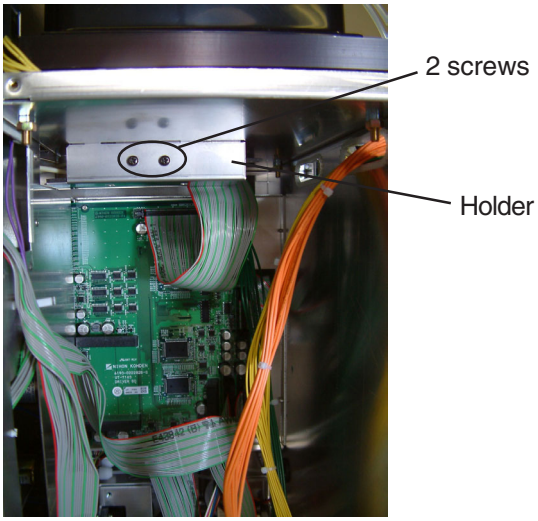
To assemble the hematology analyzer, reverse the above procedure.

Removing the Laser Optical Unit

1. Drain all the fluid from the hematology analyzer according to the procedure described in “Draining the Hematolozy Analyzer”.
2. Remove the top cover according to the procedure described in “Removing the Top Cover”.
3. Remove the rear cover including the power supply unit according to the procedure described in “Removing the Rear Cover Including the Power Supply Unit”.
4. Remove the 4 nuts (M5) which secure the laser optical unit to the chassis. Use a suitable hex socket driver.

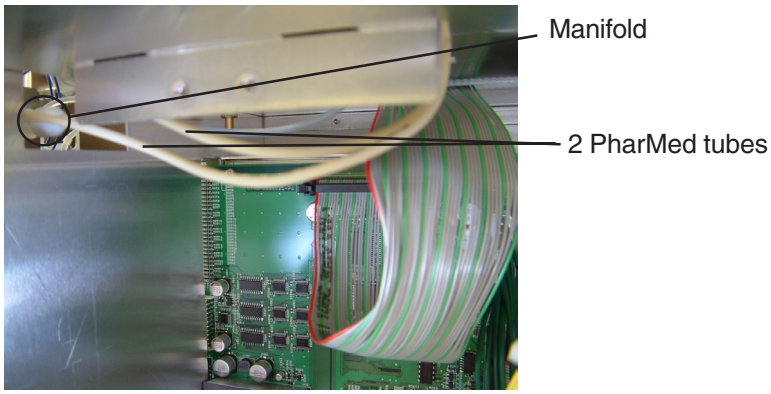


5. Remove the 2 screws which secure the flow cell unit to the holder.

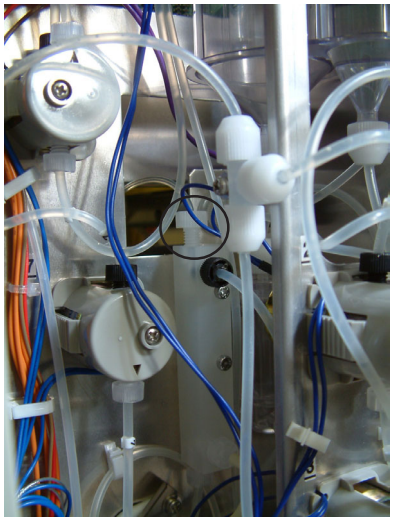


6. Move the holder leftward and downward and remove it from the laser optical unit.

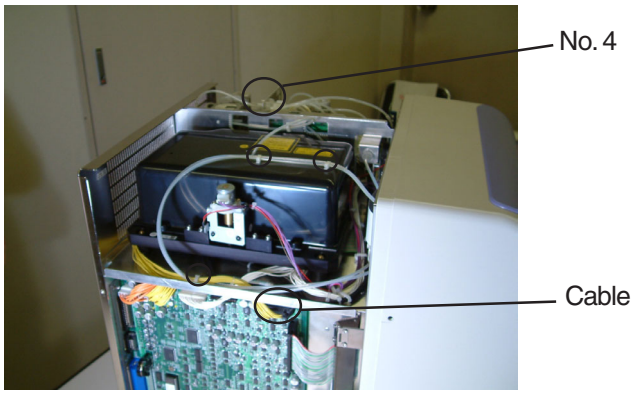
7. Disconnect the 2 PharMed tubes from the single manifold.



8. Disconnect the tube joint at the manifold of the sheath unit as shown below.



9. Remove the tube joint No. 4. Release the 3 tube ties. Disconnect the cable as shown below. Remove the laser optical unit and flow cell adjuster from the chassis.



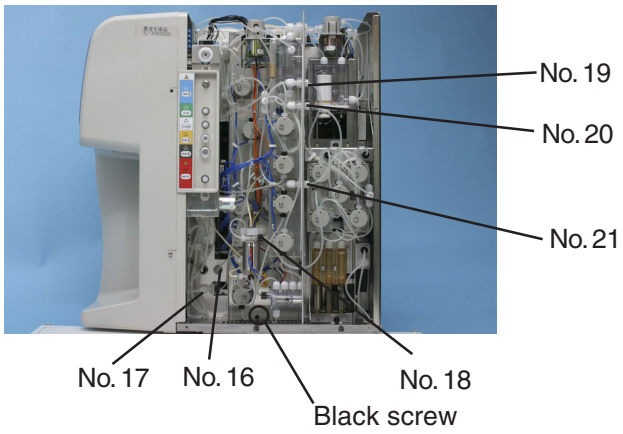
NOTE

To remove only the laser optical unit. separate the flow cell adjuster from the laser optical unit. Refer to the "Removing the Flow Cell Adjuster".

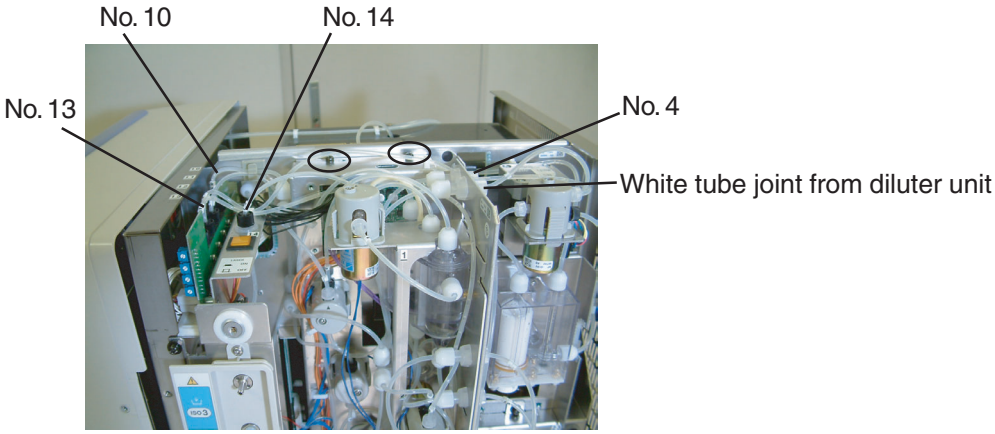
To assemble the hematology analyzer, reverse the above procedure.

Removing the Sheath Unit

1. Drain all the fluid from the hematology analyzer according to the procedure described in “Draining the Hematolozy Analyzer”.
2. Remove the top cover according to the procedure described in “Removing the Top Cover”.
3. Remove the rear cover including the power supply unit according to the procedure described in “Removing the Rear Cover Including the Power Supply Unit”.
3. Disconnect the 6 tube joints (No. 16 to No. 21) as shown below.

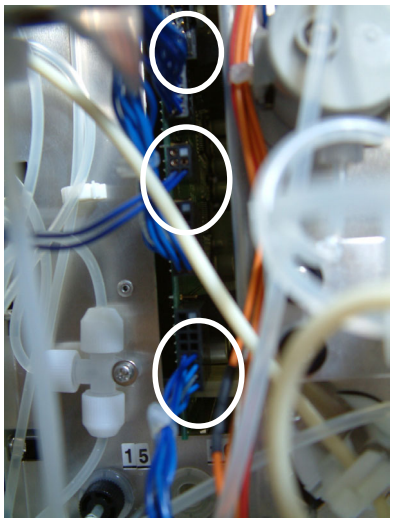


5. Remove the black screw which secures the lower part of the sheath unit to the chassis.
6. Disconnect the 4 black tube joints (No. 4, No. 10, No. 13, No. 14) and white tube joint from the diluter unit.

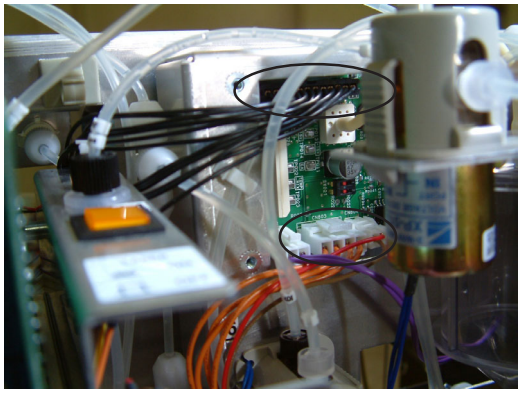


7. Remove the 2 black screws which secure the upper part of the sheath unit to the chassis.

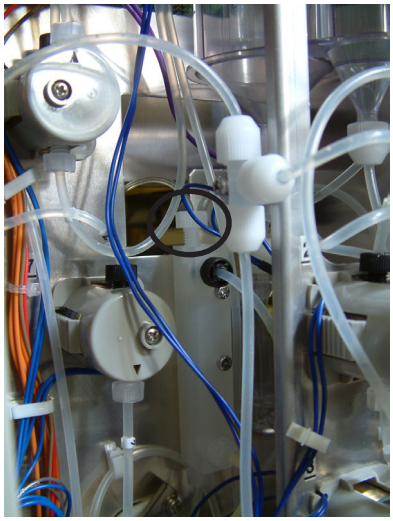
8. Disconnect the 3 cables between the sheath unit and DRIVER board.



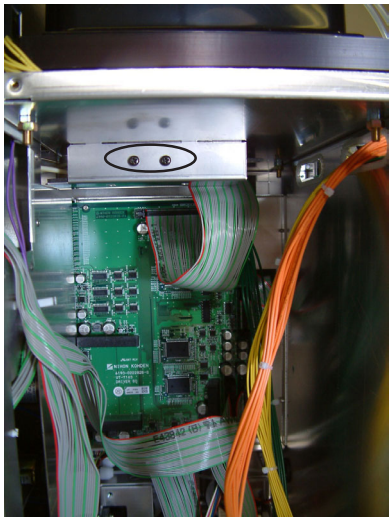
9. Disconnect the 2 cables at the SHEATH board as shown below.



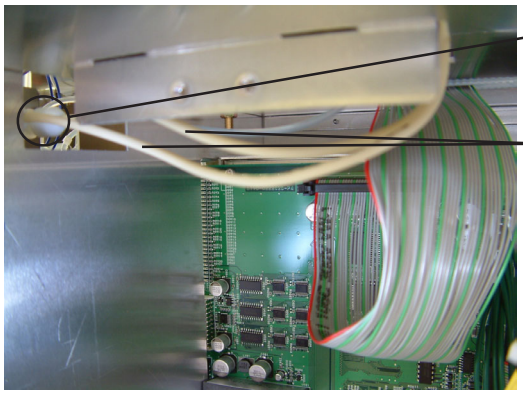
10. Disconnect the tube joint from the manifold of the sheath unit.



11. Remove the 2 black screws which secure the flow cell unit holder.



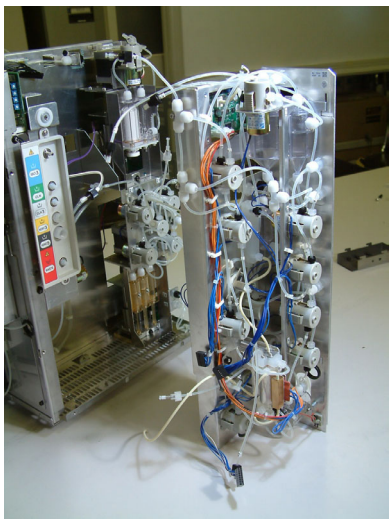
12. Move the holder leftward and downward and remove it from the laser optical unit.
13. Disconnect the 2 PharMed tubes from the single manifold.



14. Pull the sheath unit upward and pull it toward you.

CAUTION

When removing the sheath unit from the chassis, check that there is no damage on the tubes and cables connected to the sheath unit.



To assemble the hematology analyzer, reverse the above procedure.

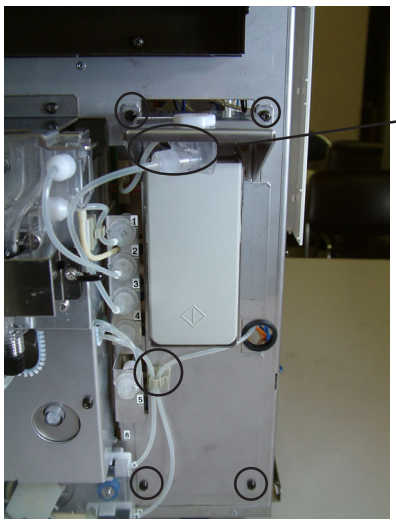
Removing the Rinse Unit and Switch Assembly

1. Press the main power switch on the rear panel to turn the power off. The power lamp and main power lamp go off.

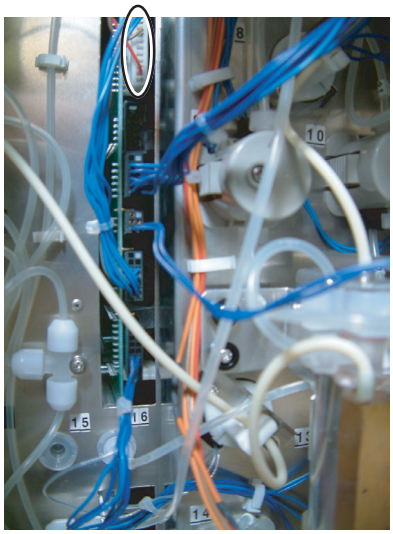
WARNING

For your sefety, before disassembling the hematolozy analyzer, wait approx. 10 minutes after turning off the main power switch.

2. Open the front cover according to the procedure described in “Opening the Front Cover”.
3. Remove the top cover according to the procedure described in “Removing the Top Cover”.
4. Disconnect the 2 tube joints connected to the rinse unit.



5. Release the tube tie which binds the 2 tubes.
6. Remove the 4 screws which secure the rinse unit and switch assembly to the chassis.
7. Disconnect the white connector of the assembly as shown below.



To assemble the hematology analyzer, reverse the above procedure.

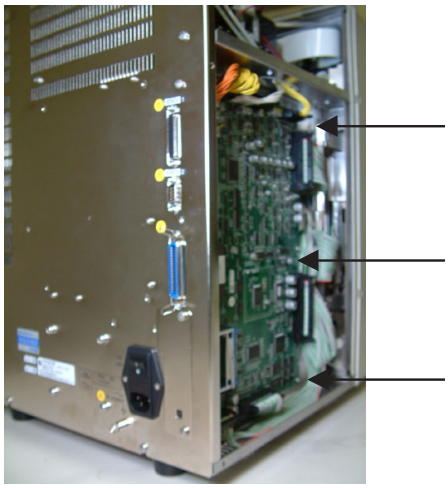
Replacing the AMP CONTROL Board

1. If there are different settings from the default settings on the CALIBRATION and SETTINGS screens, write down these settings.
2. Press the main power switch on the rear panel to turn the power off. The power lamp and main power lamp go off.

WARNING

For your sefety, before disassembling the hematolozy analyzer, wait approx. 10 minutes after turning off the main power switch.

3. Remove the top cover according to the procedure described in “Removing the Top Cover”.
4. Remove the rear cover according to the procedure described in “Removing the Rear Cover Including the Power Supply Unit”.
5. Disconnect the 9 connection cables from the AMP CONTROL board.
6. Remove the 3 screws which secure the AMP CONTROL board to the chassis. Remove the board from the chassis.



7. Attach the new AMP CONTROL board to the original position with the 3 screws.

8. Connect the 9 connection cables to the AMP CONTROL board.
9. Put the rear cover and top cover back to the original positions.
10. Turn on the main power switch on the rear panel.
11. Continue pressing the Reset key, Clean key and Dispense/Open key on the front panel, press the Power key on the panel, release the Power key, and release the Reset key, Clean key and Dispense/Open key.
12. While pressing the Reset key, press the Capillary blood mode key on the front panel. The TOUCH SCREEN CALIBRATION screen appears. Adjust the touch screen properly. Refer to "Calibrating Touch Screen" in Section 9 "Maintenance" of the operator's manual.
13. Initialize the settings according to “Initializing Settings” in Section 3 “Changing Settings” of the operator’s manual.
14. Enter the settings which you wrote down in step 1.

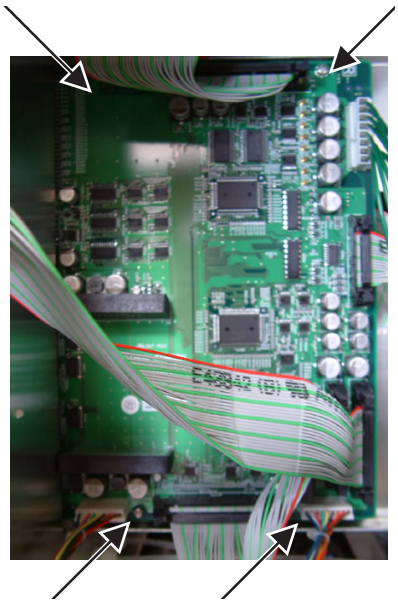
Replacing the DRIVER Board

1. Press the main power switch on the rear panel to turn the power off. The power lamp and main power lamp go off.

WARNING

For your sefety, before disassembling the hematolozy analyzer, wait approx. 10 minutes after turning off the main power switch.

2. Remove the top cover according to the procedure described in “Removing the Top Cover”.
3. Remove the rear cover according to the procedure described in “Removing the Rear Cover Including the Power Supply Unit”.
4. Disconnect the 8 connection cables from the DRIVER board.
5. Remove the 4 screws which secure the DRIVER board to the chassis. Remove the DRIVER board from the chassis.



6. Attach the new DRIVER board to the chassis with the 4 screws.
7. Reverse the above procedure to assemble the hematology analyzer.

Replacing the VOLUME Board, KEY DISPLAY Board and LCD Unit

1. Press the main power switch on the rear panel to turn the power off. The power lamp and main power lamp go off.

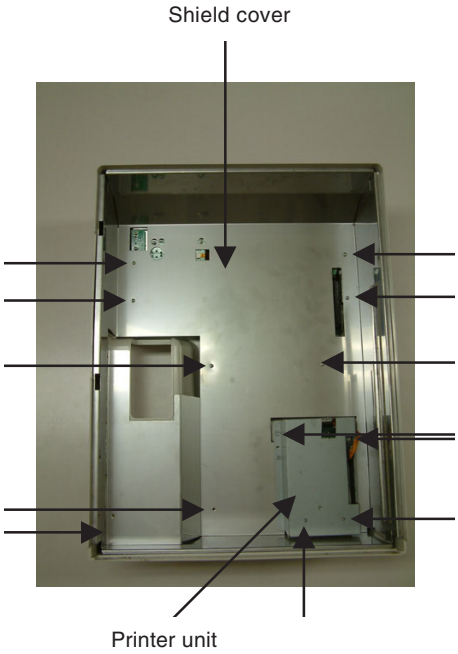
WARNING

For your sefety, before disassembling the hematolozy analyzer, wait approx. 10 minutes after turning off the main power switch.

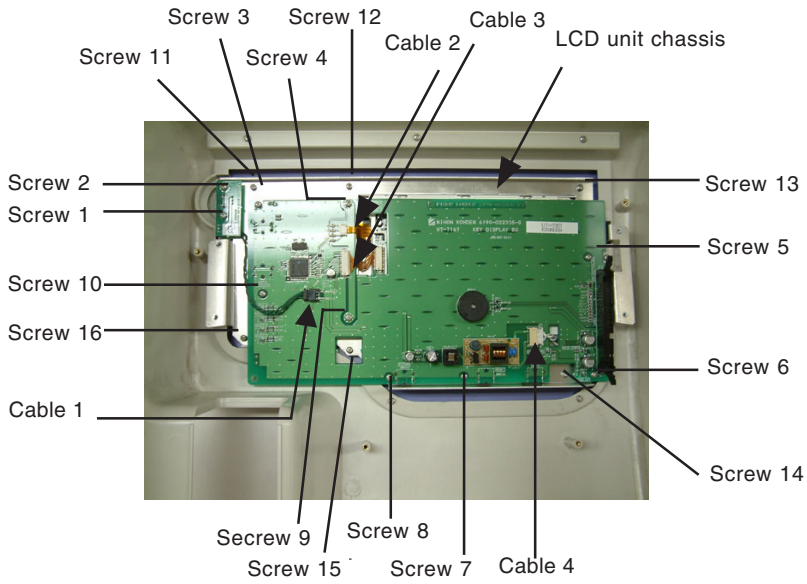
2. Remove the front panel unit according to the procedure described in "Removing the Front Panel Unit".
3. Remove the 12 screws which secure the optional printer unit and shield cover to the front panel unit. Remove first the printer unit and second the shield cover from the front panel unit.

CAUTION

Pay attention to the sharp edges of the shield cover. It can cause cuts or injuries. To reduce these possibilities, wear gloves.



4. To remove the VOLUME board, disconnect the cable 1 at the KEY DISPLAY board and remove the 2 screws (screws 1 and 2) from the VOLUME board.



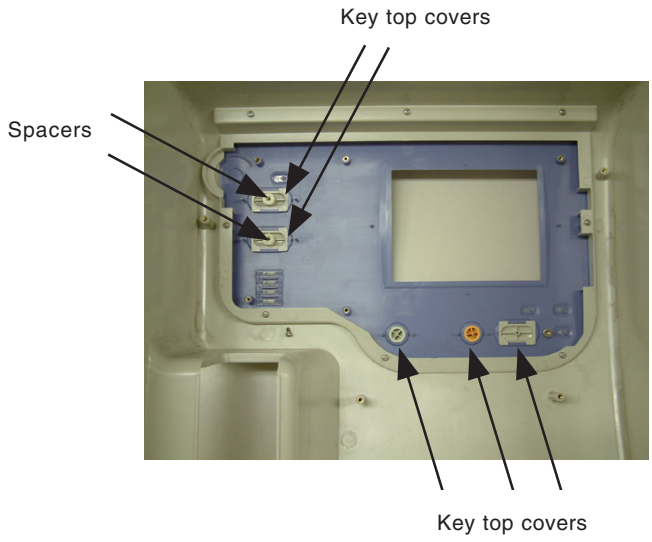
NOTE

The VOLUME board is not available. If this board has a problem, only the variable resistor will be sent to you for replacement.

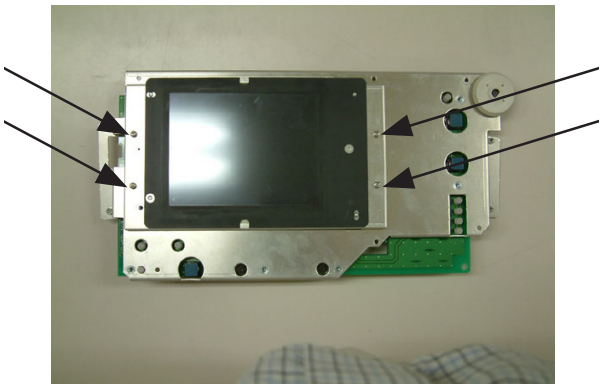
5. To remove the KEY DISPLAY board, disconnect the 4 cables (cables 1 to 4) from the board and remove the 8 screws (screws 3 to 10) from the board.
6. To remove the LCD unit, put the front panel unit face down on a table covered with a clean, soft and smooth antistatic material, disconnect the 3 cables (cables 2 to 4) from the KEY DISPLAY board, remove the 6 screws (screws 11 to 16) from the LCD unit chassis, and remove the LCD unit chassis from the front panel unit by pulling the LCD unit chassis toward you.

NOTE

If the front panel unit is not put face down on a flat space, the following key top covers and spacers will be apart from the original positions.

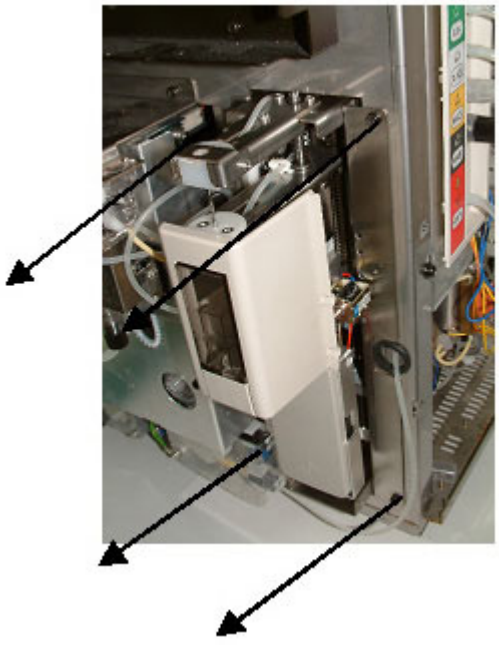


7. Turn the LCD unit chassis face up on the table.
8. Remove the 4 screws which secure the LCD unit to the chassis. Remove the LCD unit from the chassis.



Replacing the MS-721V Cap Pierce Unit (Option)

1. Drain all the fluid from the hematology analyzer according to the procedure described in “Draining the Hematolozy Analyzer”.
2. Open the front cover according to the procedure described in “Opening the Front Cover”.
3. Remove the top cover according to the procedure described in “Removing the Top Cover”.
4. Move the sampler unit leftward by hand.
5. Disconnect the 2 tubes from the rinse unit.
6. Disconnect the 2 cables connected to the cap pierce unit at the DRIVER board.
7. Remove the 4 screws which secure the cap pierce unit to the chassis.



8. Pull the cap pierce unit toward you.
9. Put the new cap pierce unit to the original position and reverse the above procedure to assemble the hematology analyzer.

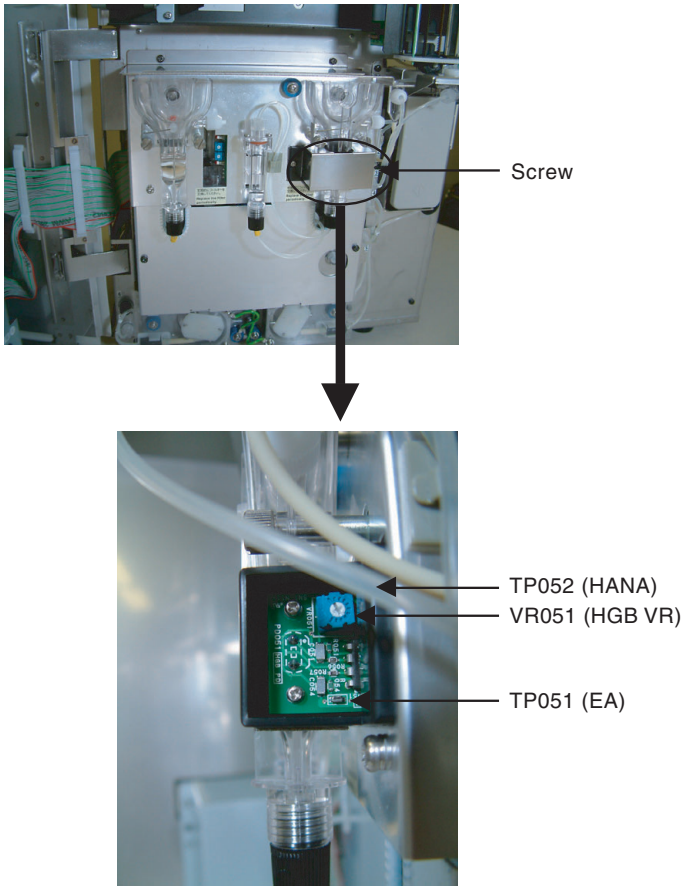
Section 5 Adjustment

Adjusting HGB Sensor Output Voltage 5.1
Adjusting Upper and Lower Sensor Output Voltage of the Manometer 5.2
Compensating manometer Volume 5.3
Adjusting Gain for WBC 5 Part Differential Measurement 5.4
- Counting the Polymer Microsphere Suspensions and Adjusting the Flow Cell Position 5.5
- Adjusting Gain for WBC 5 Part Differential Measurement Roughly by Polymer Microsphere Suspensions 5.9
- Adjusting Gain for WBC 5 Part Differential Measurement Finely by Human Blood Sample 5.10
- Editing the Peak List 5.13
- Manually Adjusting the Gain 5.15

Compensating Dilution Ratio 5.15
Calibrating Touch Screen 5.16
Adjusting Liquid Sensor Output Voltages 5.17
Adjusting Contrast of LCD 5.18

Adjusting HGB Sensor Output Voltage

1. Open the front cover according to the procedure described in “Opening the Front Cover” of Section 4 “Disassembly and Assembly”.
2. Remove the screw which secures the HGB cover to the CBC measuring unit chassis. Remove the HGB cover.



3. Fill the sub bath for the WBC measurement bath with diluent.
4. Press the OTHER key on the MENU screen. The OTHER screen appears.
5. Press the SENSOR MONITOR key on the OTHER screen. The SENSOR MONITOR screen which displays each sensor output voltage appears.
6. Adjust the VR051 (HGB VR) variable resistor on the HGB board so that the HGB LED ON voltage is 3 V ±0.1 V.
7. Connect a digital voltmeter between the TP051 (EA) and TP052 (HANA) test points and check that the voltage between the TP051 and TP052 test points is 3 V ±0.1 V. If the voltage is out of the range, adjust the VR051 (HGB VR) variable resistor for 3 V ±0.1 V.

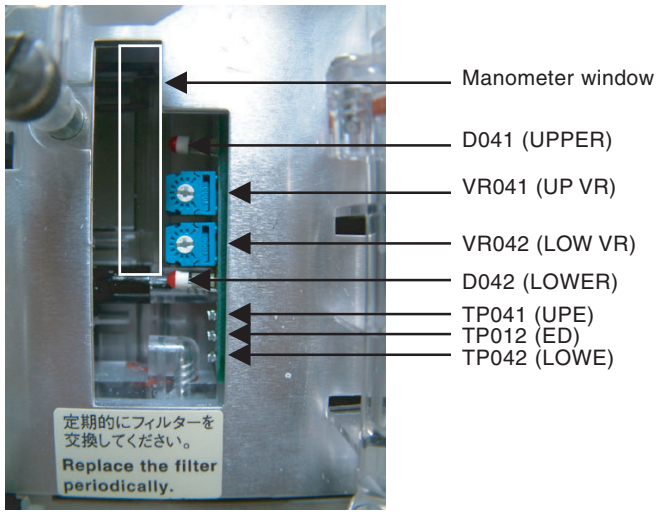
NOTE

If the output voltage from the sensor is less than before when the diluent is aspirated through the aperture cap, it does not affect the HGB measurement value but the resolution for HGB measurement decreases. Refer to “Hemoglobin Measurement” in Section 10 “Reference” of the operator’s manual.

NOTE in Assembling the Instrument

Before closing the front cover, check that the HGB cover is attached to the original position.

Adjusting Upper and Lower Sensor Output Voltage of the Manometer



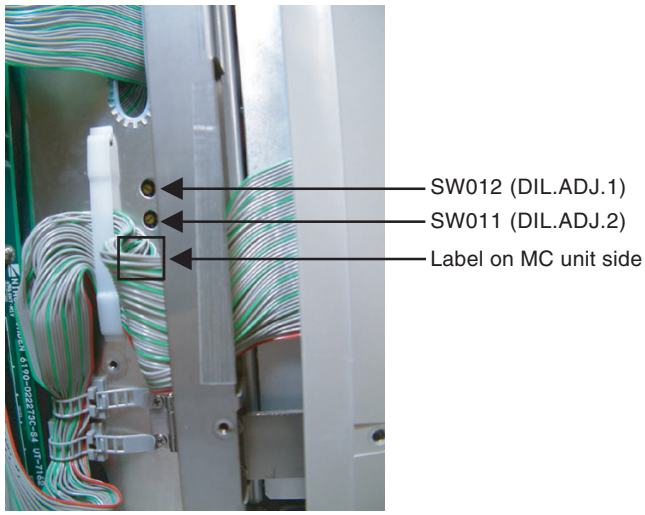
1. Open the front cover according to the procedure described in “Opening the Front Cover” of Section 4 “Disassembly and Assembly”.
2. Press the OPERATIONS key on the MENU screen. The OPERATIONS screen appears.
3. Press the PRIME key on the OPERATIONS screen. The “PRIMING” message appears on the screen. When the WBC and RBC measurement baths fill with diluent, watch the manometer window as shown above and check that the manometer also fills with diluent. Also check that the two LEDs, D041 (UPPER) and D042 (LOWER), light.
4. Press the OTHER key on the MENU screen. The OTHER screen appears.
5. Press the SENSOR MONITOR key on the OTHER screen. The SENSOR MONITOR screen which displays each sensor output voltage appears.
6. Adjust the VR041 (UP VR) and VR042 (LOW VR) variable resistors on the MANOMETER board so that each sensor output voltage is 1.5 V or less.
7. Press the count switch and watch the diluent level in the manometer. When the diluent level is lower than the bottom of the manometer, press the reset key. Check that there is no diluent in the manometer. Also check that the two LEDs, D041 (UPPER) and D042 (LOWER), do not light.
8. Press the OTHER key on the MENU screen. The OTHER screen appears.
9. Press the SENSOR MONITOR key on the OTHER screen. The SENSOR MONITOR screen which displays each sensor output voltage appears.
10. Adjust the VR041 (UP VR) and VR042 (LOW VR) variable resistors so that each sensor output voltage is 3.5 V or more.
11. Press the OPERATIONS key on the MENU screen. The OPERATIONS screen appears.

12. Press the PRIME key on the OPERATIONS screen. The “PRIMING” message appears on the screen. When the WBC and RBC measurement baths fill with diluent, watch the manometer window and check that the manometer also fills with diluent. Also check that the two LEDs, D041 (UPPER) and D042 (LOWER), light.

NOTE

- **Since the threshold for fluid detection in the manometer is set to around 2.5 V, an alarm such as UPPER MANO ERROR or LOWER MANO ERROR can occur when the sensor output voltage comes closer to 2.5 V.**
- **When the difference between the sensor output voltages with fluid and without fluid becomes less than 2 V, a bubble alarm can frequently occur because the difference voltage is not enough to discriminate between the two statuses. To maintain the difference voltage 2 V or more, clean the manometer completely before checking the sensor output voltages.**

Compensating Manometer Volume



When the manometer is disassembled and assembled or replaced with a new one, perform the compensation of the manometer volume. Refer to the following example. The label of the default compensation value set at our factory is attached to the CBC measuring unit.

There are two rotary switches on the PRE AMP board. Each rotary switch selects one of 10 terminals.
The rotary switch for the first digit of the two-digit compensation value has 0.2% increment or decrement per terminal. The rotary switch for the second digit of the two-digit compensation value has 2% increment or decrement per terminal.

When the WBC, RBC and PLT data have 2% decreases with the hematology control after replacing the manometer with a new one, change the compensation value with the rotary switches so that the WBC, RBC and PLT data have 2% increase.

If the first digit and second digit rotary switches are set to “3” and “5”, respectively, the compensation value is “53”.
To increase the WBC, RBC and PLT data, decrease the compensation value.
In this case, to have 2% increases at WBC, RBC and PLT data, change the compensation value “53” to “43” because 2%/0.2%=”10". Therefore, set the second digit rotary switch to “4”.

If you change the compensation value from “53” to “60”, the WBC, RBC and PLT data have 1.4% decrease because “7” x 0.2%=1.4%.

Adjusting Gain for WBC 5 Part Differential Measurement

When the scattergrams appear outside their allotted area on the screen or the flags frequently appear, adjust the gain for WBC 5 part differential measurement.

Two steps must be performed. First adjust the gain roughly by measuring 7 µm polymer microsphere suspensions. Then adjust the gain minutely by measuring human blood.

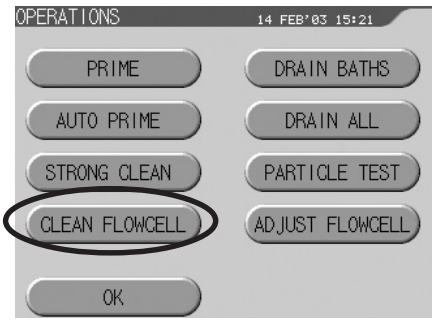
Observe the instructions on the 7 µm polymer microsphere suspensions manual to achieve optimum performance and safety.

CAUTION

- **Do not swallow the polymer microsphere suspensions. If swallowed, contact your physician immediately.**
- **Avoid contact with the mouth and eyes. If the polymer microsphere suspensions contacts the mouth or eyes, wash thoroughly and immediately with water, and contact your physician immediately.**

Counting the Polymer Microsphere Suspensions and Adjusting the Flow Cell Position

The hematology analyzer uses the light scatter technique to differentiate WBC into 5 parts. To ensure accurate laser beam scatter for the sample blood cells, count the polymer microsphere suspensions and adjust the flow cell position.



1. Clean the flow cell to remove dusts or bubbles inside the flow cell. Press the CLEAN FLOWCELL key on the OPERATIONS screen to clean the flow cell. Refer to "Cleaning the Flow Cell" in Section 9.

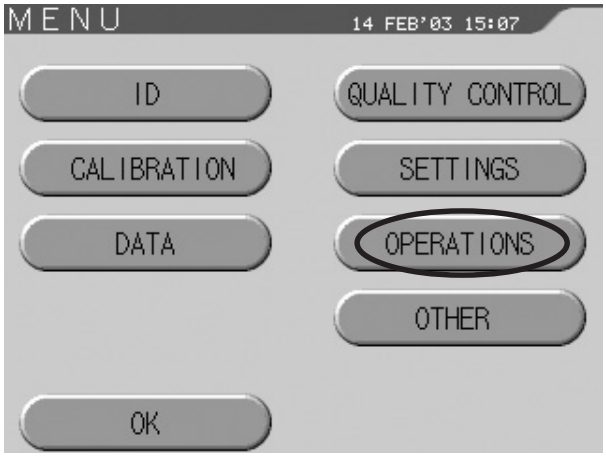
NOTE

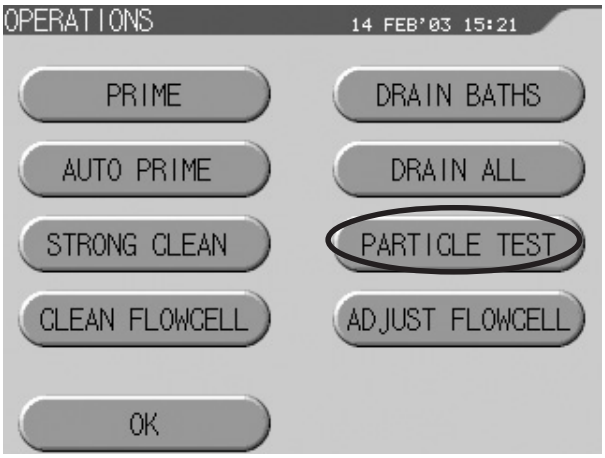
After cleaning, if an alarm appears to indicate there is not sufficient amount of diluent, detergent or hemolysing reagent in the bottle, refill the bottle and clean the flow cell again.

2. Prepare about 1 mL of polymer microsphere suspensions in a sample container.

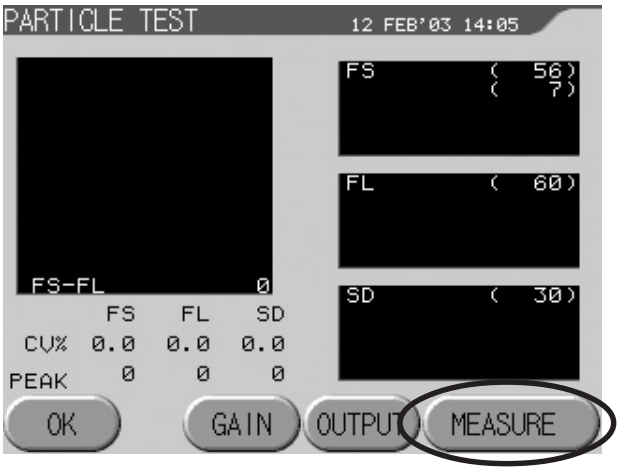
   When the MS-721V cap pierce unit is installed, select OPEN mode on the ORDER screen.

3. Press the OPERATIONS key on the MENU screen to display the OPERATIONS screen.

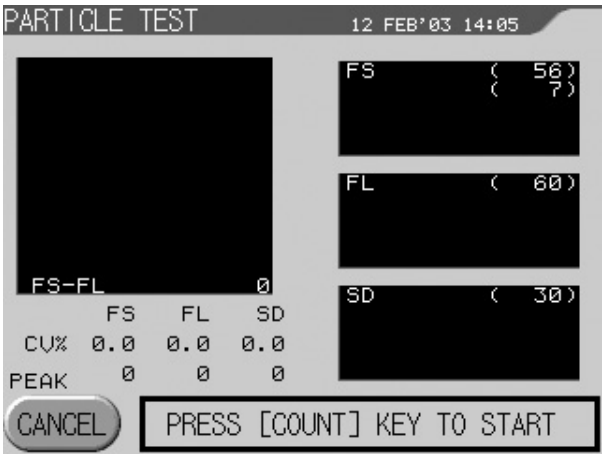


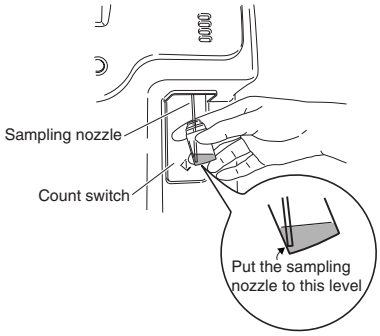


4. Press the PARTICLE TEST key to display the PARTICLE TEST screen.



5. Press the MEASURE key. The "PRESS [COUNT] KEY TO START" message appears and the hematology analyzer is ready for counting the polymer microsphere suspensions.



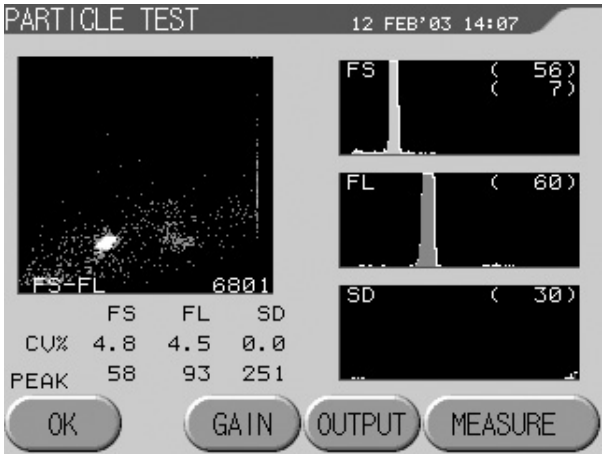


6. Put the sampling nozzle into the bottom of the sample container containing the polymer microsphere suspensions so that the tip of the sampling nozzle comes near the bottom of the sample container, and press the Count switch. The polymer microsphere suspensions is aspirated and measurement starts. The "MEASURING PARTICLES" message appears on the screen and the scattergrams and histograms appear in real-time. The measurement lasts approximately 40 seconds.

NOTE

Do not let the sampling nozzle touch the bottom of the sample container. This may prevent aspiration of the polymer microsphere suspensions.

The result appears on the screen.

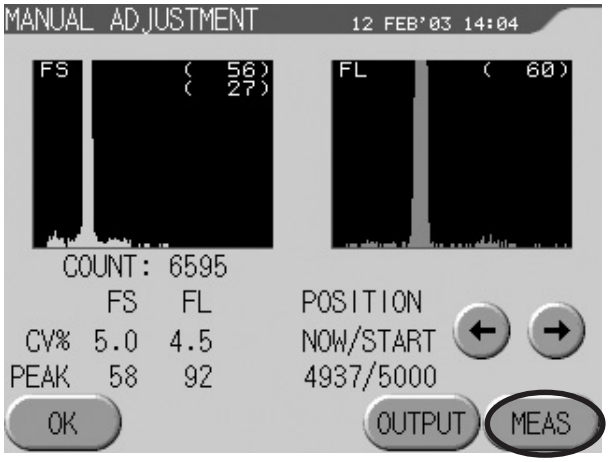


If the CV of FS and FL are below 7%, go to "Adjusting Gain for WBC 5 Part Differential Measurement Roughly by Polymer Microsphere Suspensions" section.

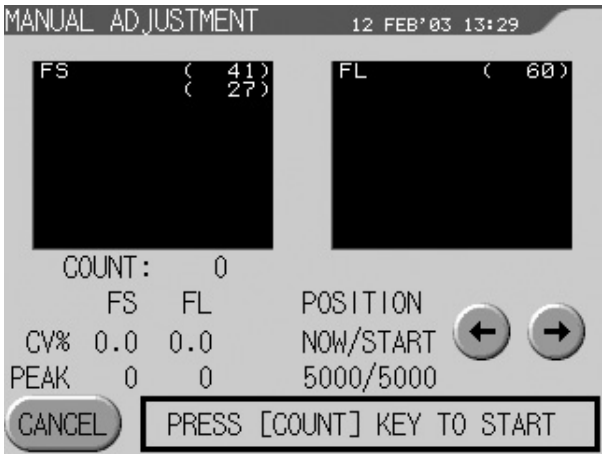
If the CV of FS and FL are above 7%, repeat the procedure to clean the flow cell and measure polymer microsphere suspensions again. Then proceed to next step.

7. Press the ADJUST FLOWCELL key on the OPERATIONS screen to display the ADJUST FLOWCELL screen.

8. Press the MANUAL ADJUST key.

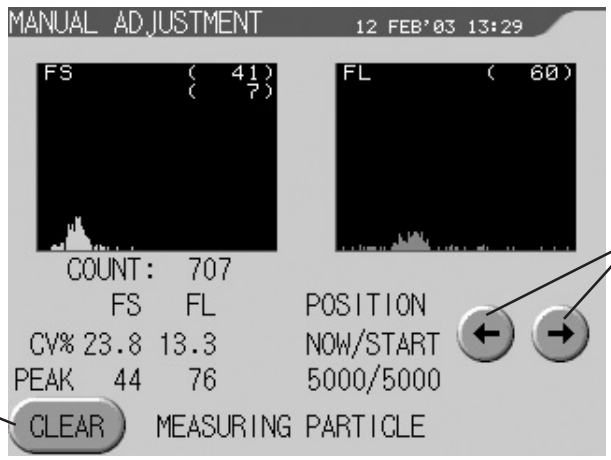


9. Press the MEAS key. The "PRESS [COUNT] KEY TO START" message appears.



10. Count the polymer microsphere suspensions again. Refer to step 6.

11. Press the → or ← key to adjust the flow cell position. The histogram is automatically redrawn. Adjust the flow cell until the CV of FS and FL is minimum and the peak is maximum.



Adjust flow cell position

For clearing and redrawing scattergrams without adjusting flow cell position

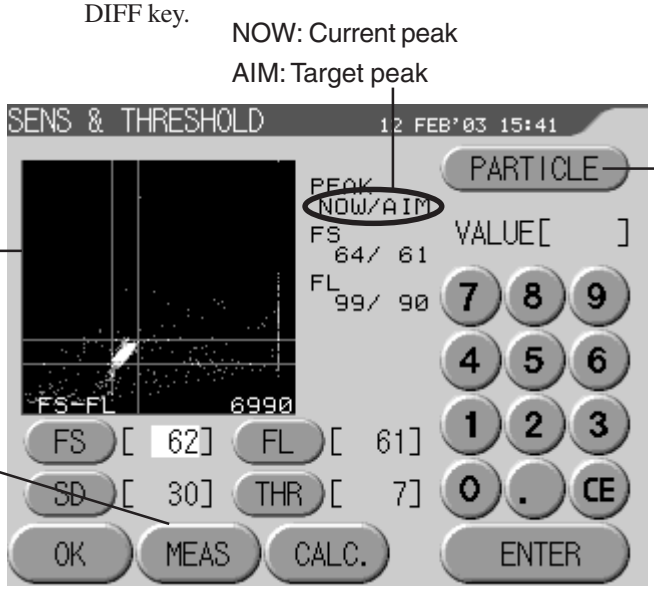
12. After adjusting the flow cell to obtain the optimum result, count the polymer microsphere suspensions again to make sure the optimum results can be obtained again. Refer to step 6.

If the CV of FS and FL are below 7% and the peaks match the following value, go to “Adjusting Gain for WBC 5 Part Differential Measurement Finely by Human Blood” section.
If the CV of FS and FL are below 7% but the peaks do not match the following value, go to “Adjusting Gain for WBC 5 Part Differential Measurement Roughly by Polymer Microsphere Suspensions” section.
FS Peak: 61 ±3 FL Peak: 90 ±3

Adjusting Gain for WBC 5 Part Differential Measurement Roughly by Polymer Microsphere Suspensions

FS (Forward Small): Size (vertical axis of the scattergram)
FL (Forward Large): Complexity (horizontal axis)
SD (Side): Granularity (horizontal axis)
THR: Threshold of FS

1. Display the SENS & THRESHOLD screen for WBC 5 part differential parameters by doing one of the following:
   a) Press the GAIN key on the PARTICLE TEST screen.
   b) Press the SENS & THRESHOLD key on the SETTINGS screen and press the DIFF key.



2. Press the sample type key to select PARTICLE. The scattergram and the peak for the polymer microsphere suspensions appear on the screen.

3. Press the CALC key. The optimal FS value calculated by the current (NOW) and target (AIM) peak values appear next to VALUE.

4. Press the ENTER key to register the value to the FS box. The value now appears next to FS and the cursor moves to FL.

5. Repeat steps 3 and 4 to register the optimal FL value.

NOTE

In PARTICLE mode, SD gain cannot be adjusted. SD gain is adjusted in fine mode by using human blood samples.

6. Press the MEAS key to return to the PARTICLE TEST screen and count the polymer microsphere suspensions again.

7. If the peak is not optimum, repeat the procedure in the "Counting the Polymer Microsphere Suspensions and Adjusting the Flow Cell Position" section until you obtain the optimum value.

NOTE

The gain adjusted by the polymer microsphere suspensions may not be the optimum gain for human blood. Every time you adjust the gain roughly by the polymer microsphere suspensions, adjust the gain in fine mode by using human blood samples.

Adjusting Gain for WBC 5 Part Differential Measurement Finely by Human Blood Sample

NOTE

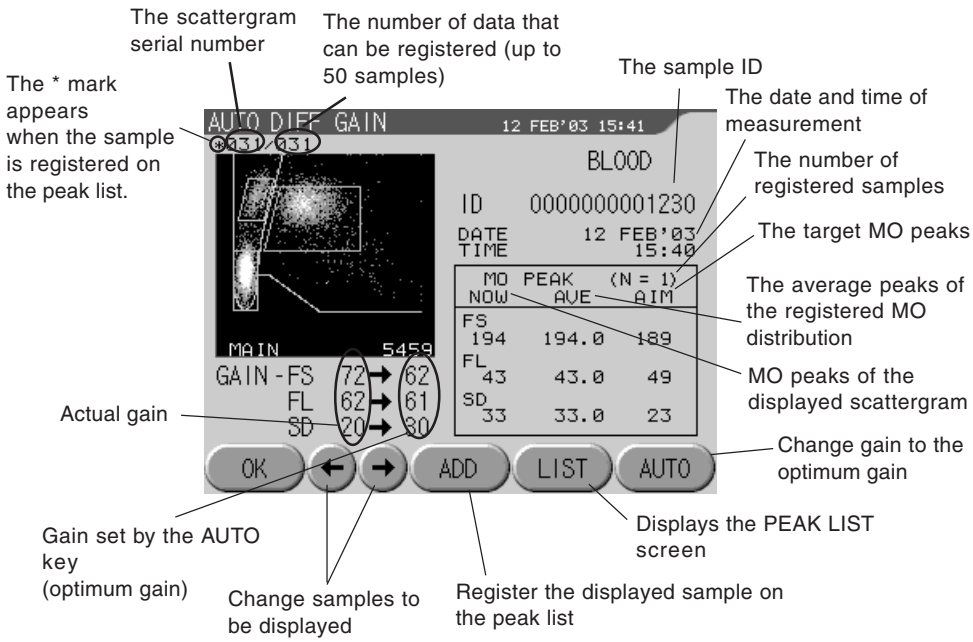
Adjust the gain in rough mode using polymer microsphere suspensions before adjusting gain in fine mode.

1. Measure 10 human blood samples from different healthy persons, which is 30 minutes to 8 hours after collection for all 22 parameters.

NOTE

- **Do not use a blood sample which was collected more than 8 hours before or refrigerated.**
- **Some blood samples may cause poor hemolysing when you use a blood sample collected within 30 minutes. In this case, leave the blood sample more than 30 minutes before measurement.**
- **Stir the blood sample carefully before measurement.**
- **Be careful that too much stirring cause poor hemolysing.**
- **Do not measure a blood sample which is clumped or clotted. This may damage the hematology analyzer.**

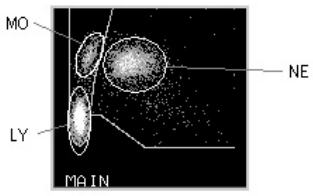
2. Press the AUTO DIFF GAIN key on the SENS & THRESHOLD screen.


The scattergram serial number
The number of data that can be registered (up to 50 samples)
The * mark appears when the sample is registered on the peak list.
The sample ID
The date and time of measurement
The number of registered samples
The target MO peaks
The average peaks of the registered MO distribution
MO peaks of the displayed scattergram
Actual gain
Change gain to the optimum gain
Gain set by the AUTO key (optimum gain)
Change samples to be displayed
Register the displayed sample on the peak list
Displays the PEAK LIST screen
AUTO DIFF GAIN
12 FEB'03 15:41
BLOOD
ID 0000000001230
DATE 12 FEB'03
TIME 15:40
MO PEAK (N = 1)
NOW AVE AIM
FS 194 194.0 189
FL 43 43.0 49
SD 33 33.0 23
MAIN 5459
GAIN-FS 72 62
FL 62 61
SD 20 80
OK
ADD
LIST
AUTO

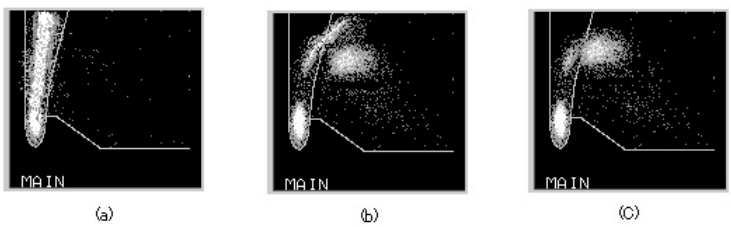
3. Register an appropriate blood sample for adjustment on the peak list.
   Register only the blood samples which can be used for adjustment. You can register up to 12 samples. You should have at least 5 samples registered. Blood samples to be registered can be displayed with the ← or → key.

   <Check points for blood samples which can be used for adjustment>
   • The distributions of NE, LY and MO are elliptical shapes on the scattergram.
   • The distributions of NE, LY and MO are separate from each other.
   • NE, LY and MO should be located in the allotted positions.

   Optimum scattergram



   Scattergrams which cannot be used for adjustment

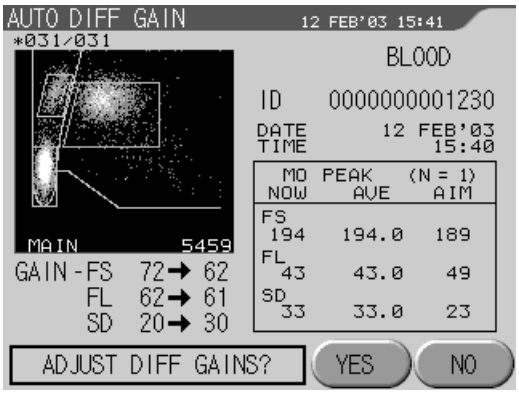


   a) There is no NE distribution, and MO and LY are not separated on the scattergram. (A scattergram of a leukemia patient.)
   b) MO is distributed on NE. (A scattergram of a patient who has immature granulocytes.)
   c) NE is distributed too close to MO. (The scattergram of a blood sample collected more than 8 hours ago.)

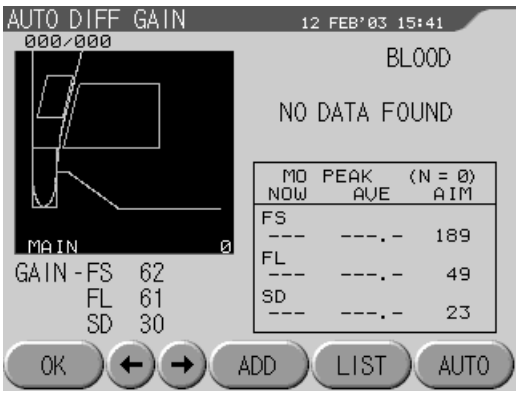
4. Press the ADD key to register the blood sample. "*" is displayed in the scattergram serial No. after registration, and the number of N in the MO PEAK table is incremented.

5. After registering blood samples to the peak list, check that the obtained result is optimum on the PEAK LIST screen. Refer to the "Editing the Peak List" section.

6. Press the AUTO key after finishing registration. The "ADJUST DIFF GAINS?" message appears.



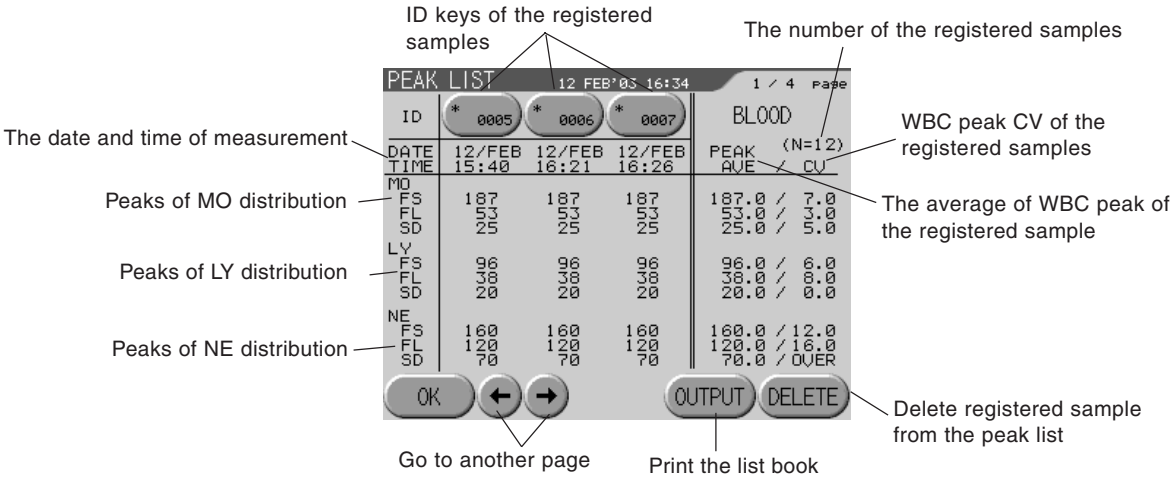
7. Press the YES key to change diff gains and the peak list of the registered blood sample is initialized.



Check the gain with a human blood sample after changing the gain.

Editing the Peak List

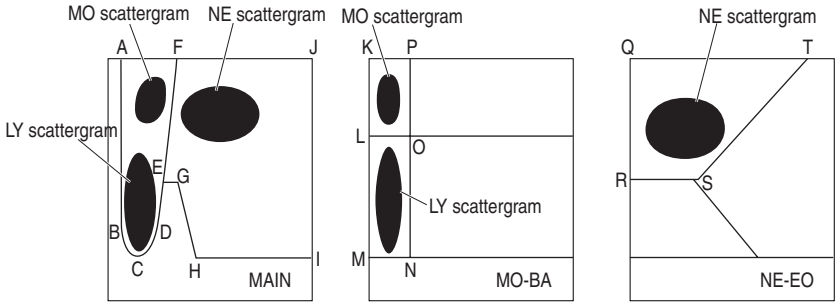
1. Press the LIST key on the AUTO DIFF GAIN screen to check and delete a registered blood sample on the PEAK LIST screen.


ID keys of the registered samples
The number of the registered samples
The date and time of measurement
WBC peak CV of the registered samples
Peaks of MO distribution
The average of WBC peak of the registered sample
Peaks of LY distribution
Peaks of NE distribution
Delete registered sample from the peak list
Go to another page
Print the list book
PEAK LIST
12 FEB'03 16:34
1 / 4 Page
ID
0005
0006
0007
BLOOD
(N=12)
DATE 12/FEB 12/FEB 12/FEB
TIME 15:40 16:21 16:26
PEAK AVE / CV
MO
FS 187 187 187 187.0 / 7.0
FL 53 53 53 53.0 / 3.0
SD 25 25 25 25.0 / 5.0
LY
FS 96 96 96 96.0 / 6.0
FL 38 38 38 38.0 / 8.0
SD 20 20 20 20.0 / 0.0
NE
FS 160 160 160 160.0 / 12.0
FL 120 120 120 120.0 / 16.0
SD 70 70 70 70.0 / OVER
OK
OUTPUT
DELETE

2. Press the sample ID key to return to the AUTO DIFF GAIN screen where the scattergram of the chosen blood sample can be checked.

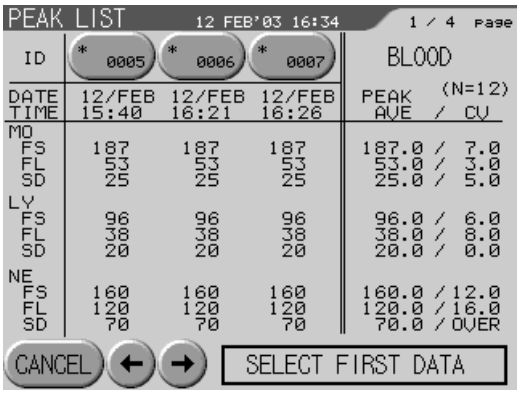
Check Points

- The MO and LY scattergrams appear within the allotted area (ABCDEF) in the MAIN scattergram.
- The NE scattergrams appear within the allotted area (FEGHIJ).
- The MO scattergrams appear within the allotted area (KLOP) in the MO-BA scattergram.
- The LY scattergrams appear within the allotted area (LMNO) in the MO-BA scattergram.
- The NE scattergrams appear within the allotted area (QRST) in the NE-EO scattergram.
- Flags do not frequently appear.

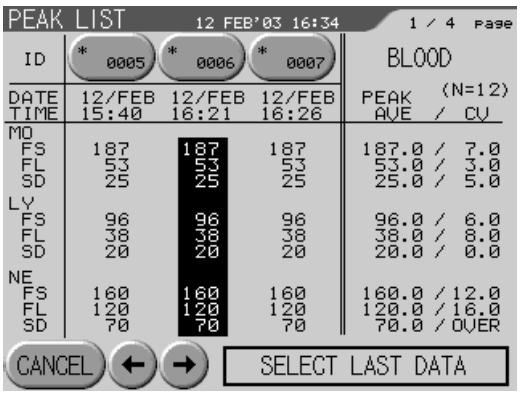


3. To delete undesirable data from the list:

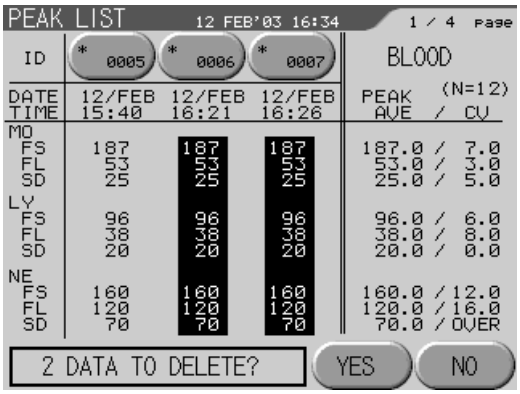
   i) Press the DELETE key on the PEAK LIST screen. The “SELECT FIRST DATA” message appears.



   ii) Press the ID key of the first sample to be deleted. The “SELECT LAST DATA” message appears.



   iii) The confirming message for deletion appears after pressing the ID key of the last sample to be deleted.



   iv) Press the YES key to delete selected data.

4. Press the OK key on the PEAK LIST screen to return to the AUTO DIFF GAIN screen.

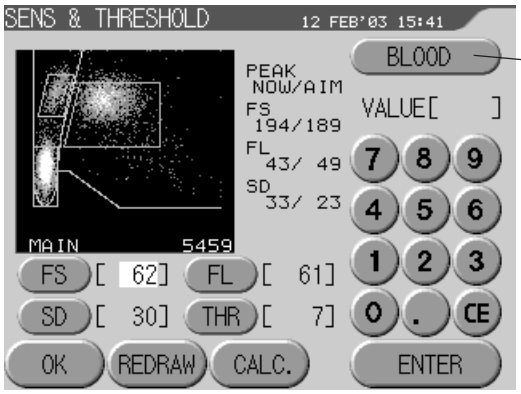
Manually Adjusting the Gain

The gain can be manually adjusted.

<Adjusting the gain with automatic calculation function>

1. Measure 10 human blood samples from different healthy persons, which is 30 minutes to 8 hours after collection for all 22 parameters.

2. Press the DIFF key on the SENS & THRESHOLD screen.



3. Select “BLOOD” for the sample type to display the scattergram, FS, FL and SD of the blood sample counted in step 1.

4. Repeat steps 3 and 4 of the procedure in the “Adjusting Gain for WBC 5 Part Differential Measurement Roughly by Polymer Microsphere Suspensions” section to automatically adjust gain for FS, FL and SD.

<Gain adjustment with numeric keypad>

1. Select the gain to be changed (FS, FL, SD or THR).

2. Enter the value with the number keys. The entered value is displayed in the VALUE box.

3. Press the ENTER key to enter the value for the selected gain.

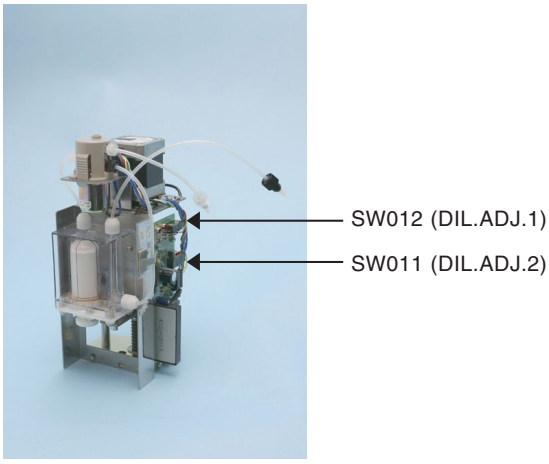
Compensating Dilution Ratio

When the cylinder block is disassembled and assembled or replaced with a new one, perform the compensation of the dilution ratio. Refer to the following example. The label of the default compensation value set at our factory is attached to the diluter unit.

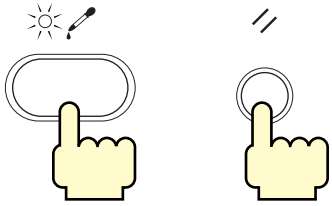
There are two rotary switches on the DILUTER DRIVER board. Each rotary switch selects one of 10 terminals.
The rotary switch for the first digit of the two-digit compensation value has 0.2% increment or decrement per terminal. The rotary switch for the second digit of the two-digit compensation value has 2% increment or decrement per terminal.

When the HGB and WBC data have 2% decrease with the hematology control after replacing the cylinder block with a new one, change the compensation value with the rotary switches so that the HGB and WBC data have 2% increase.

If the first digit and second digit rotary switches are set to “3” and “5”, respectively, the compensation value is “53”.
To increase the HGB and WBC data, decrease the compensation value.
In this case, to have 2% increases at HGB and WBC data, change the compensation value “53” to “43” because 2%/0.2%=”10". Therefore, set the second digit rotary switch to “4”. Note that the RBC and PLT data have 4 (2^2) % increase when the HGB and WBC data have 2% increase.



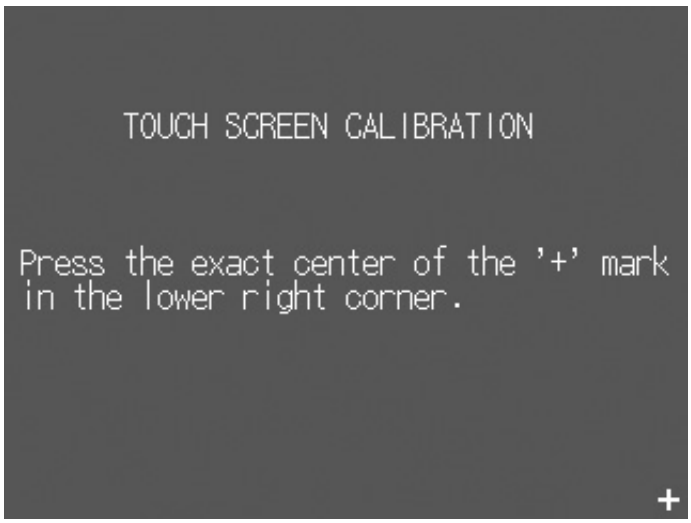
Calibrating Touch Screen



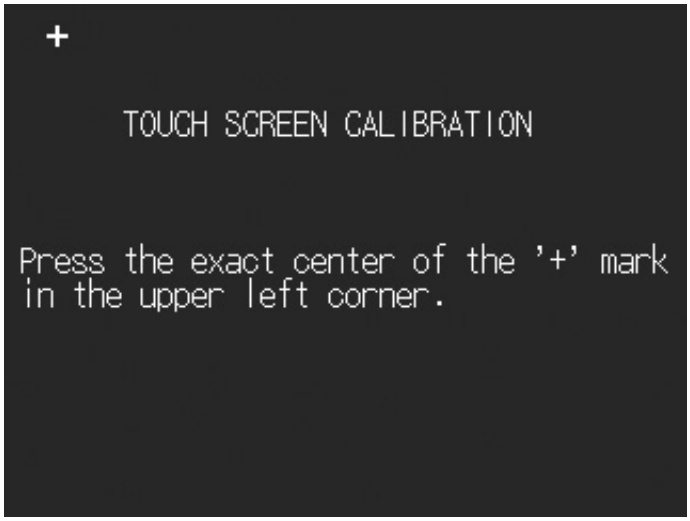
Calibrate the touch screen when the pressed position and operationg position do not match.

1. Press the Capillary mode key while holding down the Reset key.

   The TOUCH SCREEN CALIBRATION screen appears.



2. Follow the instructions on the screen to calibrate the screen.

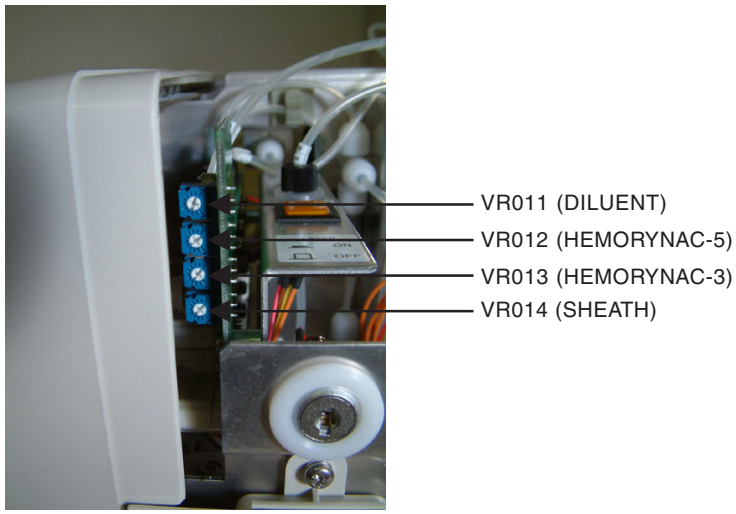


NOTE

Do not use a sharp object to press the mark. Use your finger.

After calibration ins completed, the screen returns to the READY screen.

Adjusting Liquid Sensor Output Voltages



1. Open the front cover according to the procedure described in “Opening the Front Cover” of Section 4 “Disassembly and Assembly”.
2. Disconnect the diluent, detergent and reagent tubes other than the waste fluid tube from the hematology analyzer.
3. Press the Clean key on the front panel to drain all fluid from the hematology analyzer. Alarms such as “NO DILUENT” appear on the screen.
4. Check that there is no fluid in the fluid path of the hematology analyzer.
5. Press the OTHER key on the MENU screen. The OTHER screen appears.

6. Press the SENSOR MONITOR key on the OTHER screen. The SENSOR MONITOR screen which displays each sensor output voltage appears.
7. Adjust the following variable resistors so that the sensor output voltages, SHEATH, DILUENT, HEMOLYNAC-5 and HEMOLYNAC-3, displayed on the screen are 3.5 V.

Adjusting Contrast of LCD

Turn the screen brightness control to obtain the optimal contrast of the screen.

Section 6 Maintenance

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To be Replaced Periodically

Description	NK code	Qty. (per instrument)
O-ring for manual mode sampling nozzle	315366	1 pc.
Filter for measurement bath and air trap	6144-0018990	2 pc.
Filter packing for measurement bath and air trap	2114-082062B	2 pcs.
Pump tube	2114-080599A	2 tubes
O-ring (white) for WBC aperture cap	553198	1 pc.
O-ring (red) for RBC aperture cap	553233	1 pc.
O-ring (black) for WBC and RBC aperture caps	556827	2 pcs.

Periodic Maintenance Check Procedure

Preparation

According to Section 2 “Preparation” of the operator’s manual, turn on the power and check the obtained data from the hematology analyzer before the periodic maintenance check by counting the diluent and MEK-5D hematology control. The obtained data must be printed out with the optional printer or written for the record of the maintenance check. Also check that the “Priming” operation is normal after turning on the power. Prepare a container, syringe and CLEANAC·3 detergent to clean fluid path components such as aperture cap. When calibration in capillary mode is required, prepare the T857 sample cup and T812 or T813 micro cap.

Appearance

Check that there is no damage or fluid leakage on the hematology analyzer.

Safety

Checking the power cord:

- Check that there is no damaged AC plug and exposed wire on the power cord.
- Check that the 3-pin plug type power cord is used and the 3 pins and plug housing are not deformed.
- Check that the resistance of the protective ground line of the power cord is 0.1 Ù or less by using an earth tester or check the continuity with a multimeter.

Check that the earth leakage current is 0.5 mA or less under normal condition.
Check that the earth leakage current is 1.0 mA or less under each single fault condition.

Reagents

Check that Nihon Kohden recommended diluent, detergent and hemolysing reagent are used.
Check that these reagents are used before the expiration date.

Especially, the expiration date of the Hemolynac·3 hemolysing reagent which includes cyanogen is 30 days after the package is opened while the expiration date of the Hemolynac·3N (non-cyanogen type) is 90 days after the package is opened.

If you use Hemolynac·3 which is past the expiration date, the HGB value can be lower than the actual value because the cyanogen is deteriorated. If Hemolynac·3 which is past the expiration date is used and the HGB value of the hematology control is lower than the assay sheet, suggest the customer to replace the Hemolynac·3 with a new one. If a facility does not have many blood samples and a regular size bottle of hemolysing reagent is not consumed by one hematology analyzer within the expiration date, suggest the customer to divide the hemolysing reagent into several smaller bottles for several hematology analyzers.

Cleaning/Replacing

1. Press the STRONG CLEAN key on the OPERATIONS screen to start strong cleaning.
2. Disconnect the diluent, detergent and reagent tubes other than the waste fluid tube from the right side panel of the hematology analyzer.
3. Press the DRAIN ALL key on the OPERATIONS screen to drain all the fluid inside the hematology analyzer.
4. Turn off the main power switch on the rear panel.
5. Open the front cover according to the procedure described in “Opening the Front Cover” of Section 4 “Disassembly and Assembly”.
6. Perform the following checking, cleaning and replacing.

Cleaning the rinse unit:
Clean the rinse unit according to the procedure described in “Checking and Cleaning the Rinse Unit and Sampling Nozzles” in this section.

Cleaning the cap pierce needle:
Clean the cap pierce needle according to the procedure described in “Checking and Cleaning the Cap Pierce Rinse Unit, Sampling Nozzle and Cap Pierce Needle” in this section.

Replacing the filters:
Replace the filters with new ones according to the procedure described in “Checking, Cleaning or Replacing the Filters” in this section.

Replacing the pump tubes:
Replace the pump tubes with new ones according to the procedure described in “Checking and Replacing the Pump Tubes” in this section.

Cleaning the sub baths, measurement baths and sampling cup:
Clean the sub baths, measurement baths and sampling cup according to the procedure described in “Checking and Cleaning the Sub Baths, Measurement Baths, and Sampling Cup” in this section.

Cleaning the aperture caps:
Clean the aperture caps according to the procedure described in “Cleaning the Aperture Caps” in this section.

Cleaning the touch screen:
Clean the touch screen with a soft cloth moistened with 80% alcohol.

Checking and replacing the sampling nozzles:
Check the sampling nozzles and replace them with new ones if they are damaged or PLT background noise increases according to the procedure described in "Checking and Replacing the Sampling Nozzles" in this section.

SENSOR MONITOR Screen

1. Turn on the main power switch on the rear panel.
2. While pressing the Reset key on the front panel, press the Power key on the front panel. The power turns on without priming. The READY screen appears.
3. Press the MENU key on the READY screen. The MENU screen appears.
4. Press the OTHER key on the MENU screen. The OTHER screen appears.
5. Press the SENSOR MONITOR key on the OTHER screen. The SENSOR MONITOR screen which displays each sensor output voltage appears.
6. Check that the sensor output voltages of MANO UPPER, MANO LOWER, DILUENT, HEMOLYNAC-5 and HEMOLYNAC-3 are 3.5 V or more under no fluid condition. Write down each voltage on the check sheet.
7. Connect the diluent, detergent and reagent tubes to the right side panel of the hematology analyzer.
8. Press the OPERATIONS key on the MENU screen. The OPERATIONS screen appears.
9. Press the PRIME key on the OPERATIONS screen. The screen returns to the READY screen after priming operation is completed.
10. Check that the following sensor output voltages are displayed on the SENSOR MONITOR screen. Write down each voltage on the check sheet. If there is a sensor output voltage out of the acceptable range, adjust the sensor output voltage for the acceptable range according to Section 5 "Adjustment".
    MANO UPPER, MANO LOWER, DILUENT, HEMOLYNAC-5 and HEMOLYNAC-3: 1.5 V or less
    ELECTRODE: 17.7 V to 18.3 V
    HGB LED ON: 1.5 V to 4.5 V (Adjust this voltage for 2.9 V to 3.1 V if it is out of 1.5 V to 4.5 V.)
    HGB LED OFF: 0.5 V or less

CIRCUIT CHECK Screen

1. Press the MENU key on the READY screen. The MENU screen appears.
2. Press the OTHER key on the MENU screen. The OTHER screen appears.
3. Press the CIRCUIT CHECK key on the OTHER screen. The CIRCUIT CHECK screen which displays the check result of specified measurement parameters appears.
4. Check that the following values are displayed on the CIRCUIT CHECK screen.
    WBC: 8.0±5%
    RBC: 1.6±5%
    HGB ON: 1.5 V to 4.5 V
    HGB OFF: 0.5 V or less
    MCV: 100±15%
    PLT: 160±5%

Sensitivity and threshold
WBC: 5 (sensitivity), 4 (threshold)
RBC: 5 (sensitivity), AT (AUTO) or 5 (threshold)
PLT: 5 (threshold)

Background noise

1. Press the count switch to count the diluent so that the background noise is checked. Refer to “Measuring Background Noise” in Section 2 “Preparation” of the operator’s manual. The measurement result appears.
2. Check that the following values are displayed on the screen.
   WBC: 0.2 or less (x 10^3/ìL)
   RBC: 0.05 or less (x 10^6/ìL)
   HGB: 0.1 or less (g/dL)
   PLT: 10 or less (x 10^3/ìL)
   TOC: 100 or less

Measuring the Polymer Microsphere Suspensions

1. Measure the polymer microsphere suspensions according to the procedure described in “Counting the Polymer Microsphere Suspensions and Adjusting the Flow Cell Position” in Section 3 “Changing Settings” of the operator’s manual.
2. Check that the CV of FS and FL are 7% or less on the PARTICLE TEST screen. If the CV is more than 7%, clean the flow cell, measure the polymer microsphere suspensions again, and adjust the flow cell position.

Measuring the MEK-5DN Hematology Control

1. Write down the lot number of the MEK-5DN hematology control on the check sheet.
2. Check the reproducibility by measuring the MEK-5DN hematology control. Refer to “Counting the MEK-5D Hematology Control” in Section 6 “Quality Control” of the operator’s manual.
3. Check that the obtained results are within the acceptable range. If the obtained data is out of the range, go to “New Calibration Coefficients”.

Current Calibration Coefficients

1. Press the CALIBRATION key on the MENU screen. The CALIBRATION screen appears.
2. Press the VENOUS key or CAPILLARY key on the CALIBRATION screen according to the facility’s requirement. The current calibration coefficients are displayed on the screen.
3. Write down the calibration coefficients on the check sheet if the obtained results are within the acceptable range at “Measuring the MEK-5DN Hematology Control” in this section.

New Calibration Coefficients

1. Write down the lot number of the MEK-3DN hematology control on the check sheet.
2. Measure the MEK-3DN hematology control three times. Refer to “Measuring Calibrator” in Section 7 “Calibration” of the operator’s manual.

3. Calibrate the hematology analyzer by entering the new calibration coefficient or measured data. Refer to “Calibration in Venous Blood Mode” or “Calibration in Capillary Blood Mode” in Section 7 “Calibration” of the operator’s manual.

NOTE

Before entering the new calibration coefficient or measured data, ask the customer if you can change the setting. Some customers calibrate the hematology analyzer for data consistency with other manufacturers’ hematology analyzers.

Software Version

1. Press the OTHER key on the MENU screen. The OTHER screen appears.
2. Press the OPERATION HIST key on the OTHER screen. The OPERATION HISTORY screen appears. It displays the software version, total operating time, total number of counts, and number of counts that filters and pump tubes are used. Refer to “Displaying Operation History Screen” in this section.
3. Write down the software version on the check sheet.

Checking the Operations

Touch screen

Check the touch screen function. Refer to “Calibrating Touch Screen” in this section.

Date and time

Check the date and time settings. Refer to “Setting Date and Time” in Section 3 “Changing Settings” of the operator’s manual.

Automatic cleaning operation

Check that the automatic cleaning operations are normal during this maintenance check.

Fluid leakage

Check that there is no fluid leakage on the hematology analyzer, especially after each automatic cleaning operation.

Dispense operation

Check that the constant volume of the diluent is properly dispensed when pressing the Dispense/Open key on the front panel in capillary blood mode.

Open/Closed mode selection operation (when the cap pierce unit is installed)

Check that the cap pierce unit properly works when selecting the Open mode or Closed mode.

Built-in Printer Unit Operation (When the printer is installed)

Check that Pressing the Feed key on the front panel feeds the recording paper and there is no dot missing on the paper by pressing the Print key on the front panel.

External Printer Unit Operation (When the external printer is connected)

Check that the paper feed operation properly works on the external printer and there is no dot missing on the paper.

Bar Code Reader Operation (When the bar code reader is installed)

1. Clean the light emitter and detector parts with a cotton swab moistened with 80% alcohol.
2. Check that the bar code reading operation properly works.

Others

Write down any other points on the check sheet.

Displaying Operation History Screen

General

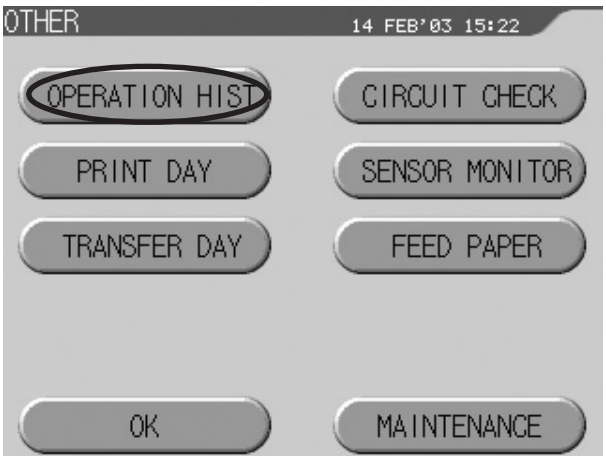
You can display the total operating time, total number of counts, and number of counts that filters and pump tubes are used to determine the maintenance schedule.

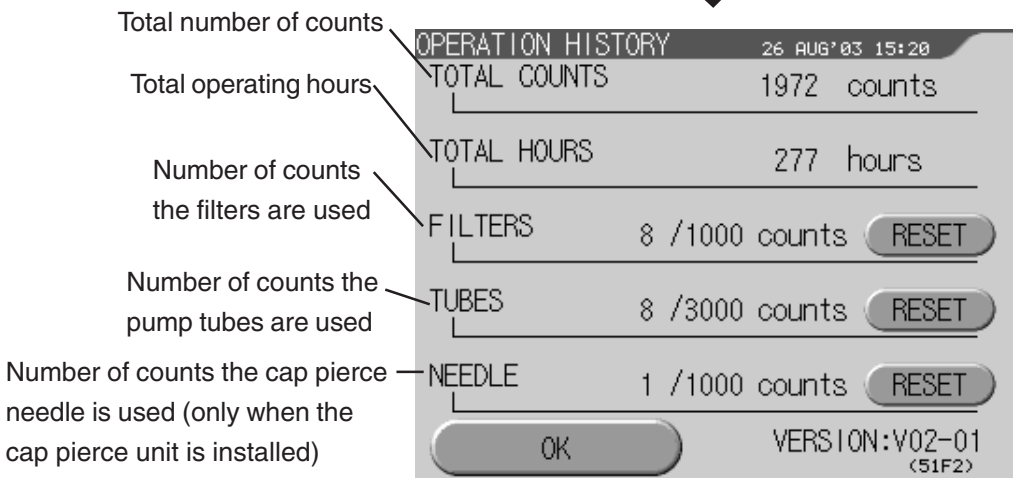
When filters or tubes are used more than the following number of sample counts, the messages appears on the READY screen to prompt you to check and replace them.

Filters:	1000 counts
Pump tubes:	3000 counts
Cap pierce needle:	1000 counts

Displaying the OPERATION HISTORY Screen

1. Press the OPERATION HIST key on the OTHER screen to display the OPERATION HISTORY screen.





The screen shows the total operating time, total number of counts, and number of counts that filters and pump tubes are used.

After checking and replacing filters or tubes and the cap pierce needle, reset the counts to zero by pressing the RESET key.

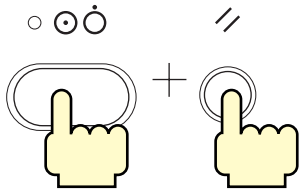
2. Press the OK key to return to the OTHER screen.

Checking, Cleaning or Replacing Filters

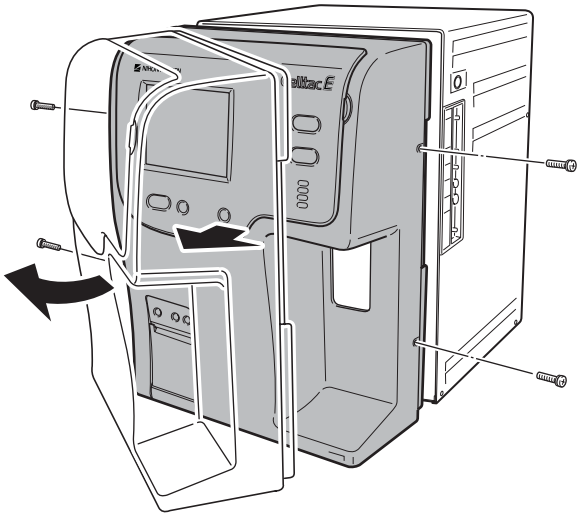
Check and clean the filters once a week or every 300 sample counts. Replace them when they are clogged or dirty (every 1000 sample counts).

1. Press the STRONG CLEAN key on the OPERATIONS screen to perform strong cleaning.

2. Press the DRAIN BATHS key on the OPERATIONS screen to drain the measurement baths and sub baths.

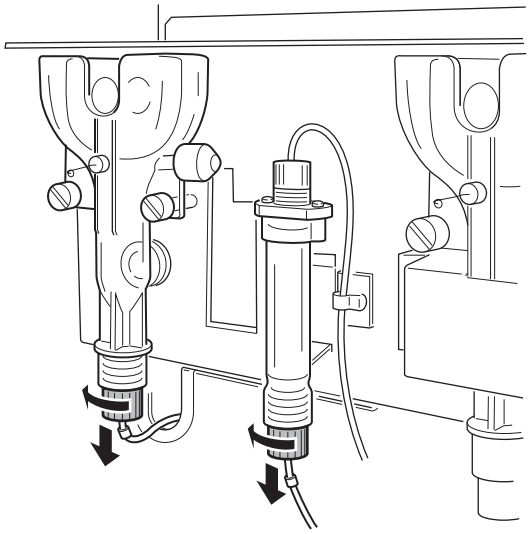


3. Press the Power key while holding down the Reset key to turn the power off. Check that the power lamp is off.

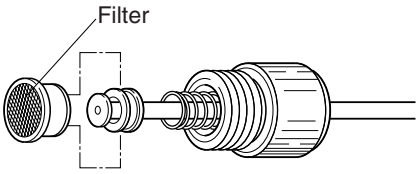


4. Remove the two screws on each side of the front cover of the hematology analyzer.

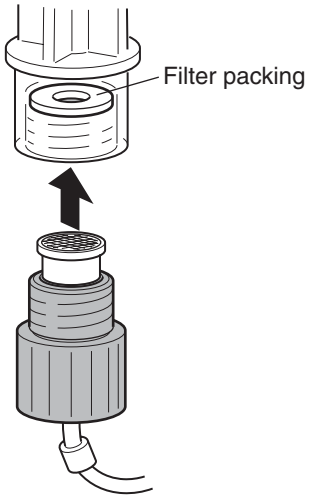
5. Open the front cover by pulling it from the right side.



6. Remove the 2 filter joint assemblies by turning the tube connectors.



7. Remove the filter from each assembly. Use tweezers to remove any dust from the filter. If it is still dirty, replace it with a new one.



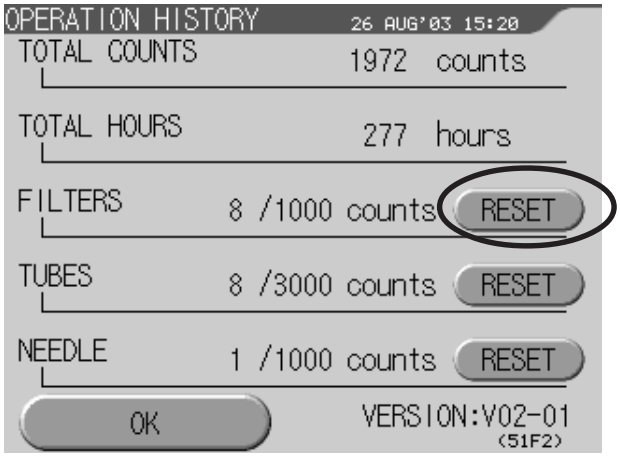
8. Reattach the filter joint assemblies.

NOTE

- **When attaching the filter joint assembly, be careful not to bend or damage the filter packing at the bottom of the measurement bath.**
- **When there is a leakage, check that there is no scratch or damage around the filter.**

9. Reattach the front cover and fasten it with the two screws on each side.

10. On the OPERATION HISTORY screen, press the RESET key for FILTERS to reset the counts to zero.



Checking and Cleaning the Sub Baths, Measurement Baths, and Sample Cup

Check the sub baths, measurement baths, and sample cup every day.

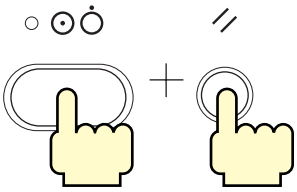
Clean the measurement baths, sub baths, and sample cup when there is any blood stain or dust on them. (Once a month or every 1000 sample counts)

NOTE

Be careful not to damage the sub baths and measurement baths. The baths are made of special plastic.

1. Press the STRONG CLEAN key on the OPERATIONS screen to perform strong cleaning.

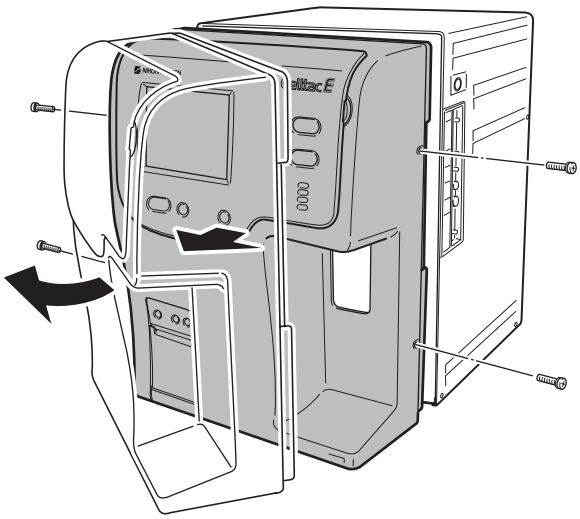
2. Press the DRAIN BATHS key on the OPERATIONS screen to drain the measurement baths and sub baths.



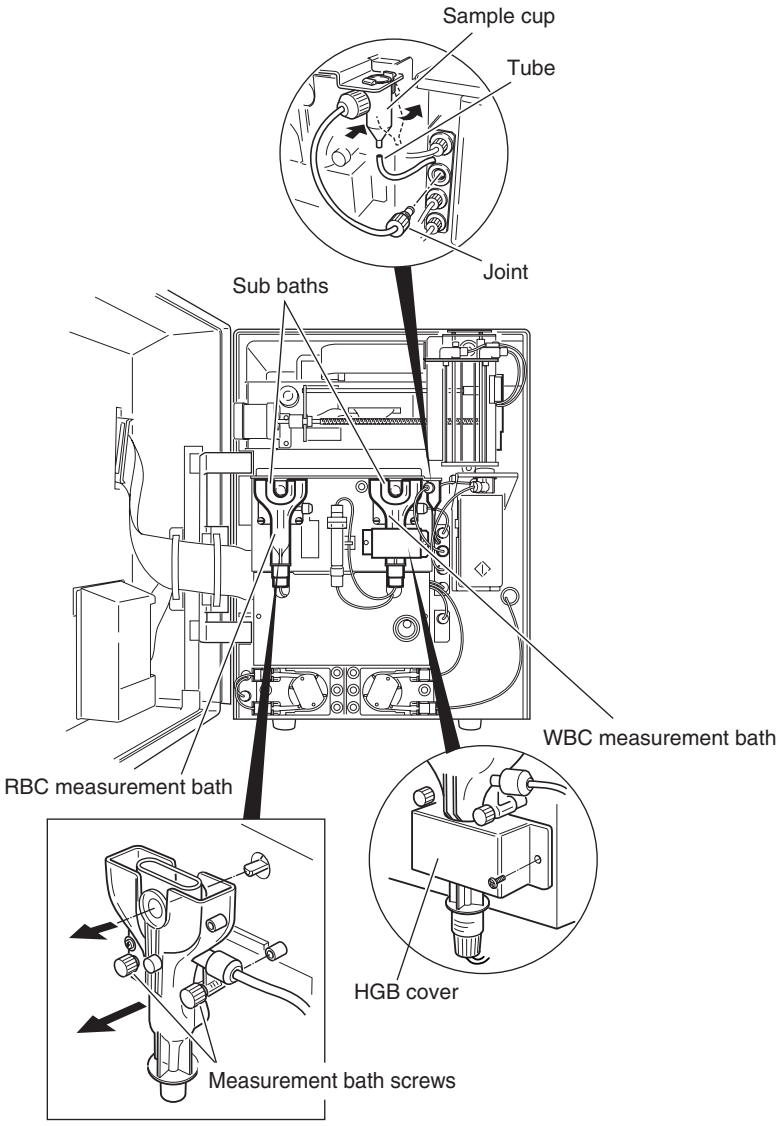
3. Press the Power key while holding down the Reset key to turn the power off. Check that the power lamp is off.

4. Remove the two screws on each side of the front cover of the hematology analyzer.

5. Open the front cover by pulling it from the right side.



6. Check the WBC and RBC measurement baths, sub baths and sample cup. If there is any blood stain or dust on them, remove and clean them taking the following steps.



7. Remove the joint of the sample cup.
8. Hold the tabs of the sample cup and push the cup back to remove it.
9. Remove the HGB cover of the WBC measurement bath by removing the screw.
10. Loosen the screws fastening the measurement baths. (The screws cannot be removed from the measurement baths.)
11. Remove the measurement baths and sub baths by pulling them together.
12. Soak the measurement baths, sub baths, and sample cup in CLEANAC•3 detergent for about 10 minutes.
13. Rinse the measurement baths, sub baths, and sample cup with water and wipe them with a dry cloth.
14. Reattach the baths and cup to its original position and tighten screws. Make sure that the baths are attached firmly, especially the sub baths.
15. Replace the HGB cover and fasten it with the screw.
16. Reattach the front cover and fasten it with two screws on each side.
17. Turn on the power. The hematology analyzer starts priming the fluid path.

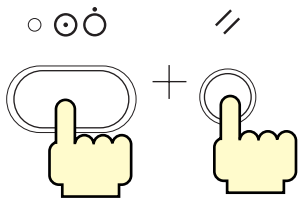
Checking and Cleaning the Rinse Unit and Sampling Nozzles

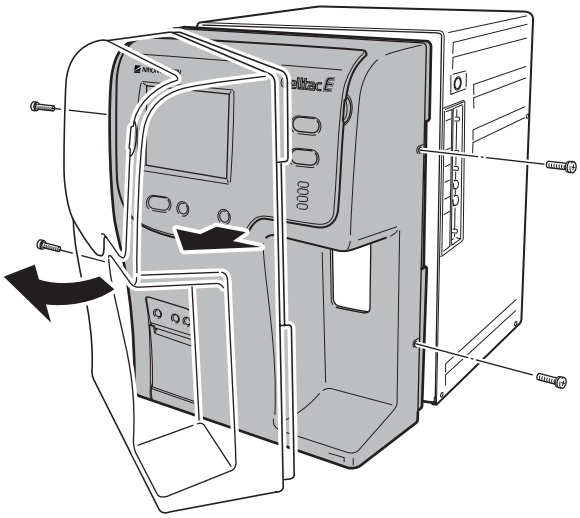
Check and clean the rinse unit and sampling nozzles once a month or every 1000 sample counts.

1. Press the STRONG CLEAN key on the OPERATIONS screen to perform strong cleaning.

2. Press the DRAIN BATHS key on the OPERATIONS screen to drain the measurement baths and sub baths.

3. Press the Power key while holding down the Reset key to turn the power off. Check that the power lamp is off.

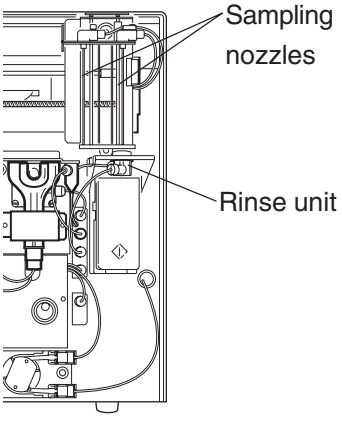


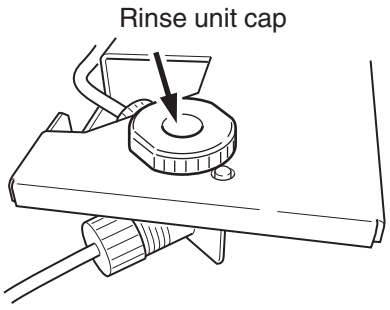


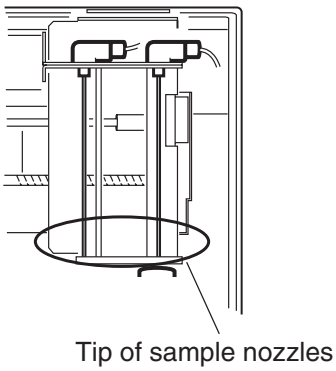
4. Remove the two screws on each side of the front cover of the hematology analyzer.

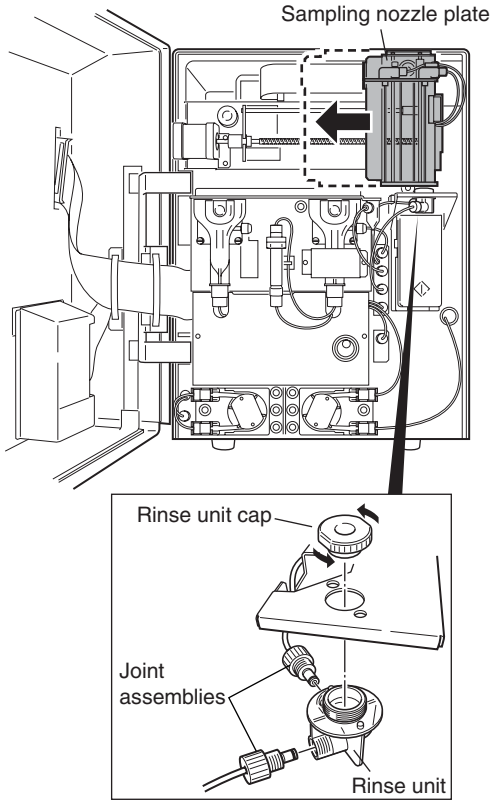
5. Open the front cover by pulling it from the right side.

6. Remove blood or salt crystals on the rinse unit cap and the tip of the sampling nozzles with a cotton swab or cloth moistened with CLEANAC•3 detergent.





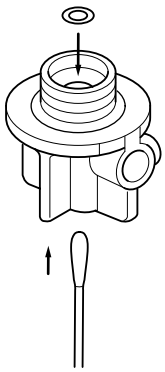




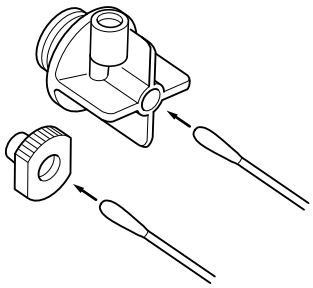
7. Slide the sampling nozzle plate to the left.

8. Turn the rinse unit cap counterclockwise to remove the rinse unit.

9. Loosen the joint assemblies to remove the tubes. Be careful not to lose the O-ring from the rinse unit.



10. Insert a cotton swab into the rinse unit from the bottom and push out the O-ring to remove it from the rinse unit.



11. Wipe the inside of the rinse unit and rinse unit cap with a cotton swab moistened with CLEANAC•3 detergent. If they are still dirty, soak them in CLEANAC•3 for about 10 minutes.

12. Rinse the rinse unit, rinse unit cap, and O-ring with water and dry thoroughly with a dry cloth.

13. Reattach the O-ring to the rinse unit and return the rinse unit and rinse unit cap to the original position.

14. Reattach the front cover and fasten it with the two screws on each side.

15. Turn the power on. The hematology analyzer starts priming the fluid path.

Checking and Replacing the Pump Tubes

Check the pump tubes for water droplets and leaks every day.

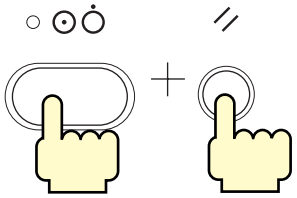
Replace the pump tubes when there are water droplets or leaks. (Once every 4 months or every 3000 sample counts)

NOTE

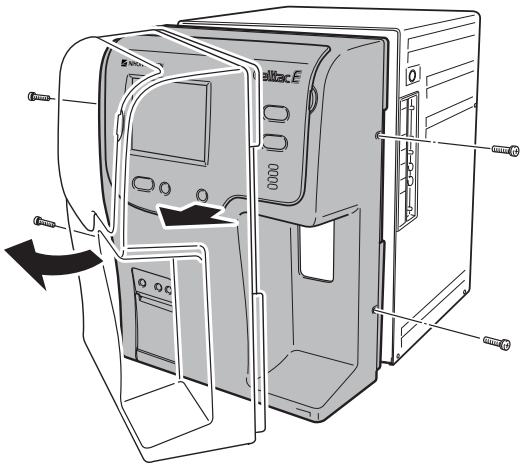
Do not leave the pump tubes with water droplets or leaks on them. This may erode them.

1. Press the STRONG CLEAN key on the OPERATIONS screen to perform strong cleaning.

2. Press the DRAIN BATHS key on the OPERATIONS screen to drain the measurement baths and sub baths.

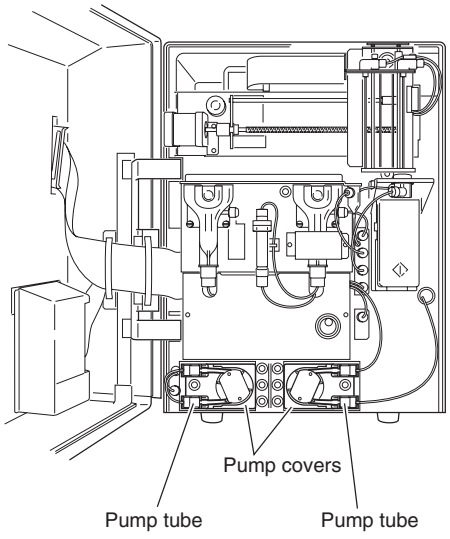


3. Press the Power key while holding down the Reset key to turn the power off. Check that the power lamp is off.



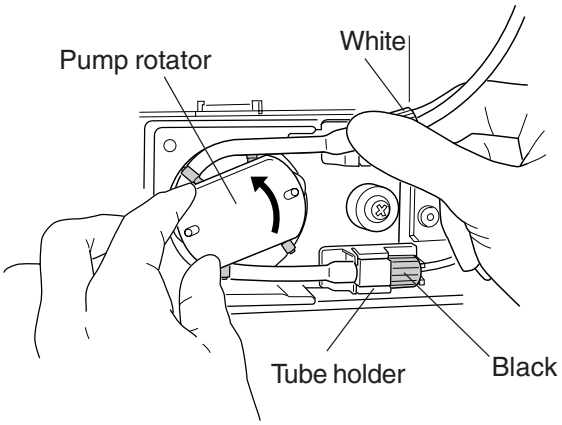
4. Remove the two screws on each side of the front cover of the hematology analyzer.

5. Open the front cover by pulling it from the right side.

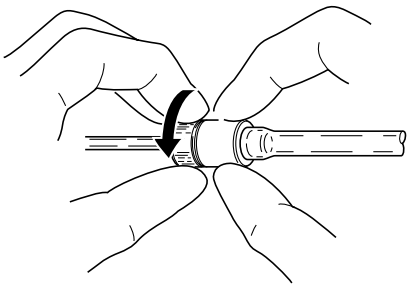


6. Check the pump tubes for water droplets and leaks. If any droplet or leak is found, replace the tube with a new one taking the following steps.

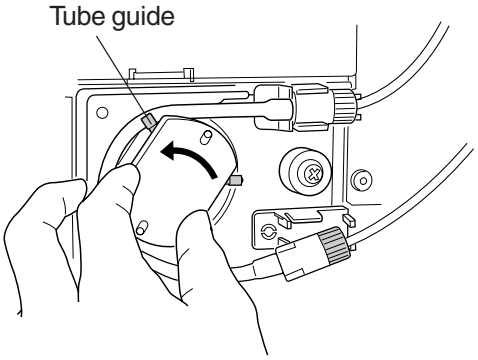
7. Remove the pump covers by removing the two screws on each cover.



8. Pull out the white tube joint from the tube holder and pull out the tube by turning the pump rotator counterclockwise. Then pull out the black tube joint from the tube holder.

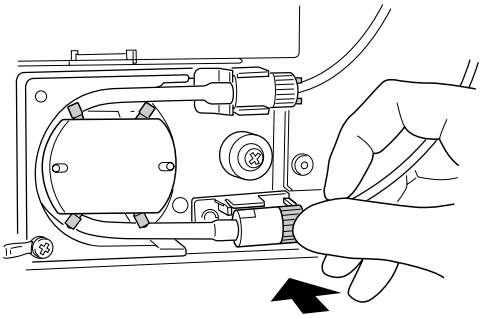


9. Remove the white and black tube joints and replace the pump tube with a new one.



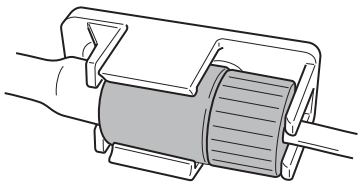
10. Put the white tube joint back to the original position and push the pump tube into the tube guide by turning the rotator counterclockwise.

11. Put the black tube joint back to the original position.



NOTE

- **Do not damage the pump tube with the tube guide.**
- **Do not attach the black tube joint to the tube holder before the white tube joint. This causes disconnection of the tube due to compressed internal air.**
- **Put back the pump tube properly. If the pump tube has slack, it will be damaged by the tube guide.**
- **Make sure the joints are held properly by the tube holder as shown below. Otherwise, the life of the pump tube will be shortened.**



12. Reattach the front cover and fasten it with the two screws on each side.

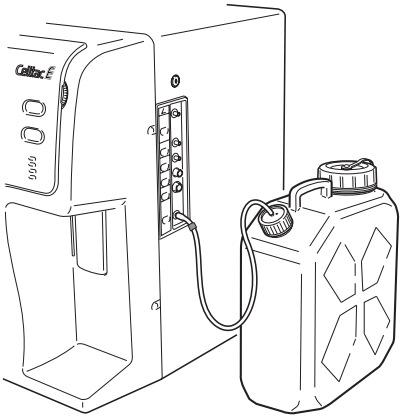
13. Turn the power on. The hematology analyzer starts priming the fluid path.

14. Display the OPERATION HISTORY screen and press the RESET key for TUBES to reset the counts to zero.

Cleaning the Aperture Caps

For daily cleaning of the aperture caps, press the Clean key on the front panel. However, if the “clogged” messages frequently appears or background noise is still high, clean the aperture caps taking the following steps.

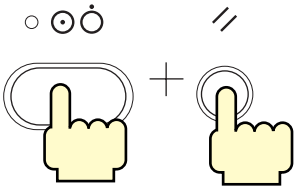
1. Press the STRONG CLEAN key on the OPERATIONS screen to perform strong cleaning.



2. Remove the diluent tube from the ISO3 inlet, the hemolysing reagent tubes from the HEMO3 and HEMO5 inlets, and the detergent tubes from the CLN and CLN3 inlets on the right side panel. Do not disconnect the waste fluid tube from the WASTE outlet.

3. Press the DRAIN ALL key on the OPERATIONS screen. A confirmation message appears on the screen.

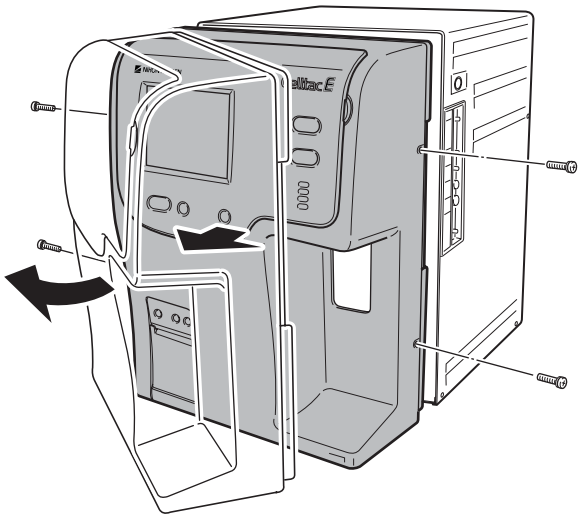
4. Press YES to start draining the hematology analyzer.

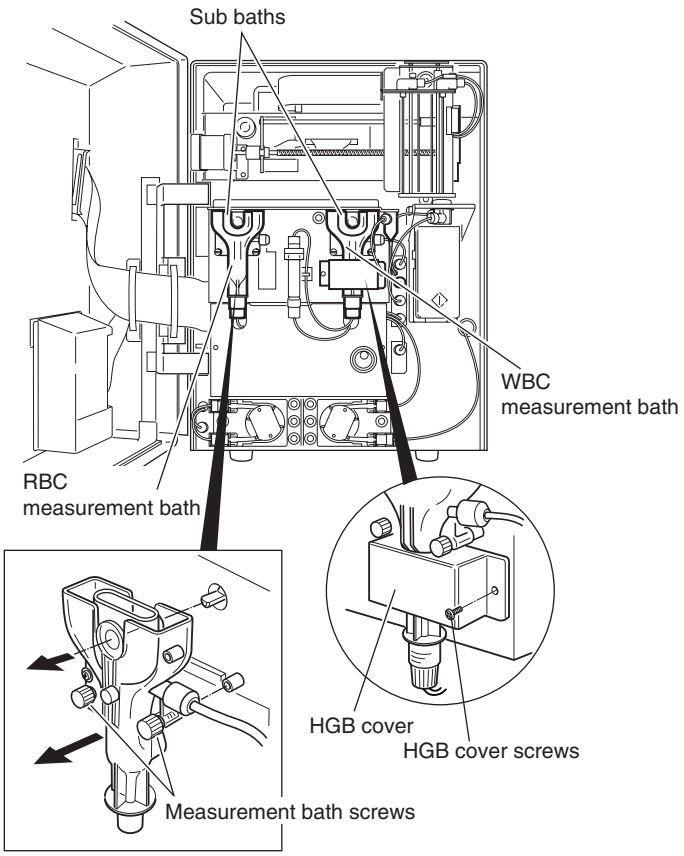


5. After draining, press the Power key while holding down the Reset key to turn the power off. Check that the power lamp is off.

6. Remove the two screws on each side of the front cover of the hematology analyzer.

7. Open the front cover by pulling it from the right side.

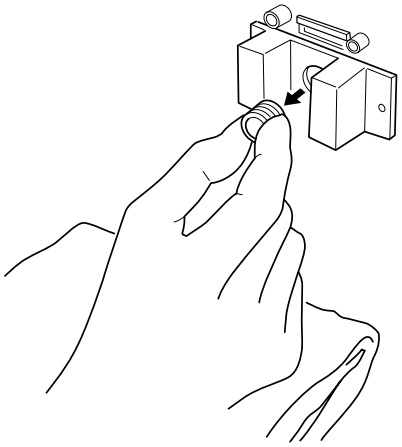




8. Remove the HGB cover of the WBC measurement bath by removing the screw.

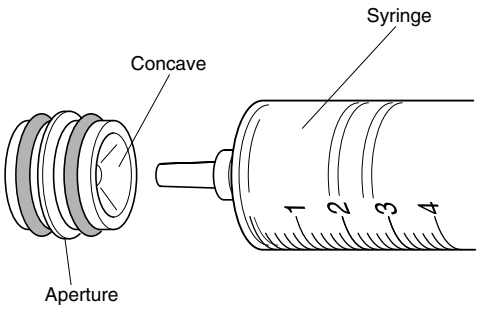
9. Loosen the screws fastening the measurement baths. (The screws cannot be removed from the measurement baths.)

10. Remove the measurement baths and sub baths by pulling them together.



11. Place a cloth or tissue paper under your hand and remove the aperture cap by pulling it toward you. If it is not easy to pull the aperture cap, move it slowly left and right to remove it.

12. Carefully rinse the aperture cap. Remove all dirt, especially from the inside.



13. Insert a syringe containing CLEANAC•3 detergent into the aperture cap. Aspirate and dispense the detergent by pressing the syringe's plunger up and down to remove the dust around the aperture cap.

NOTE

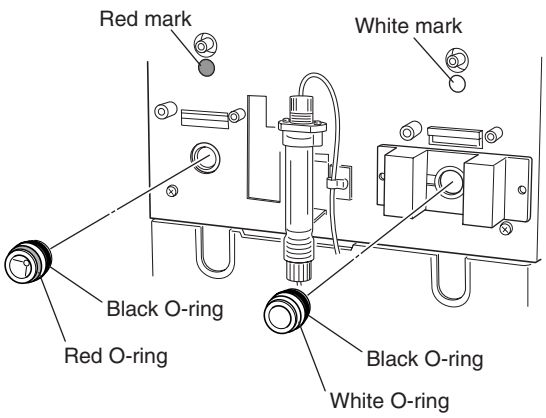
Be careful not to press the syringe with too much force. Otherwise the aperture cap may be damaged.

The condition of the aperture cap can be checked with a 100× microscope.

14. If clogged dust still remains in the aperture caps, soak the aperture caps in CLEANAC•3 detergent for about an hour.

CAUTION

Handle the aperture caps with care. It may be damaged if a sharp object is used to clean it.



15. Rinse the aperture caps with water and reattach them to the original position.

    - There are separate aperture caps for WBC and RBC. Be careful not to attach the aperture caps to the wrong positions.
      Attach the WBC aperture cap (white O-ring) to the white side.
      Attach the RBC aperture cap (red O-ring) to the red side.
    - Check that the red or white O-ring is at the front.

16. Return each bath to the original position and tighten the screws. Make sure that the baths are attached firmly, especially the sub baths.

17. Fasten the HGB cover with the screw.

18. Reattach the front cover and fasten it with the two screws on each side.

19. Turn the power on. The hematology analyzer starts priming the fluid path.

20. Count a diluent sample and check that the background noise is decreased. Refer to “Measuring Background Noise” in Section 2.

Checking and Replacing the Sampling Nozzles

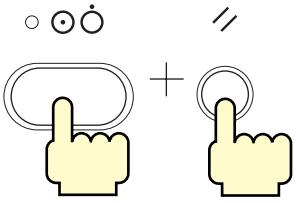
Check the sampling nozzles once a month or every 1000 sample counts taking the following steps.

When PLT background noise increases, replace the sampling nozzles with a new one.

The plastic part of the sampling nozzle for the MEK-7222J/K hematology analyzer is colored black to avoid misuse. Do not use the sampling nozzle which has a gray plastic part.

1. Press the STRONG CLEAN key on the OPERATIONS screen to perform strong cleaning.

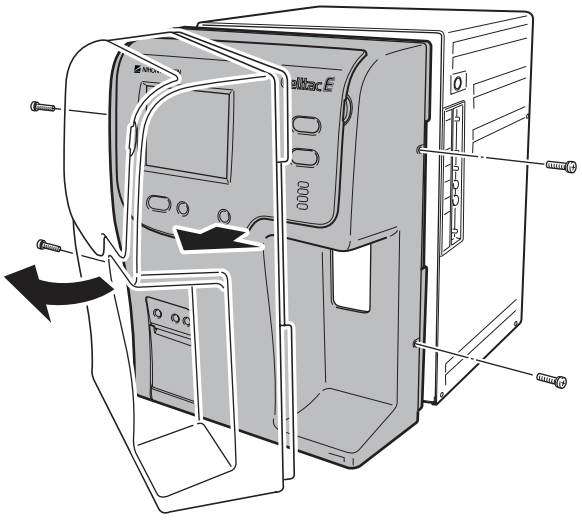
2. Press the DRAIN BATHS key on the OPERATIONS screen to drain the measurement baths and sub baths.

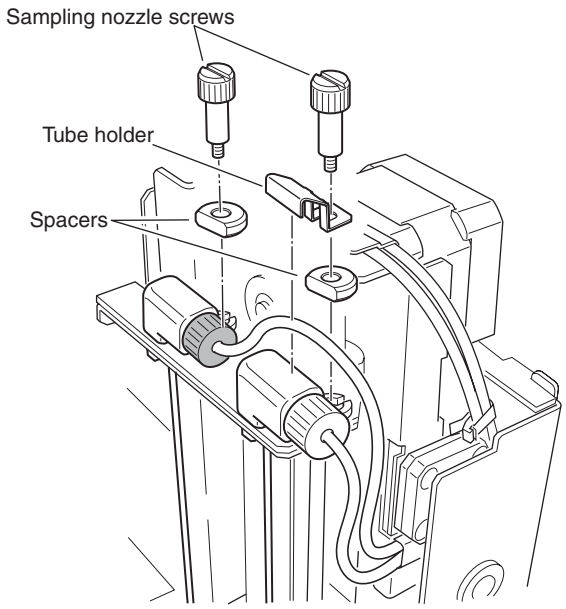


3. Press the Power key while holding down the Reset key to turn the power off. Check that the power lamp is off.

4. Remove the two screws on each side of the front cover of the hematology analyzer.

5. Open the front cover by pulling it from the right side.



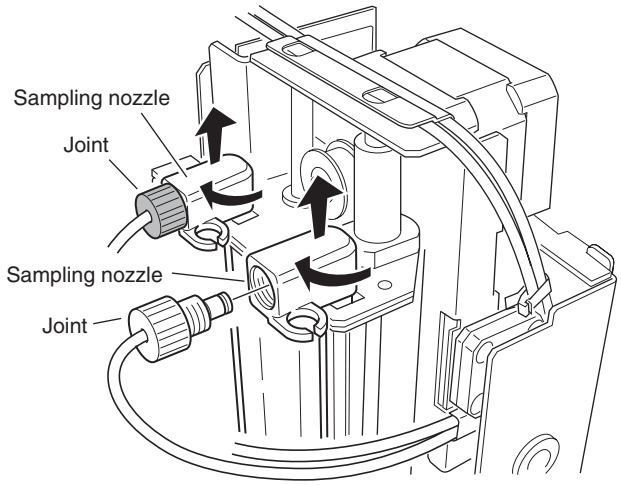


6. Check the sampling nozzles for blood stains, flaking of the coating, or bending. There are two sampling nozzles. If the sampling nozzle needs to be replaced, take the following steps.

7. Remove the screw, tube holder, and spacer from the sampling nozzle.

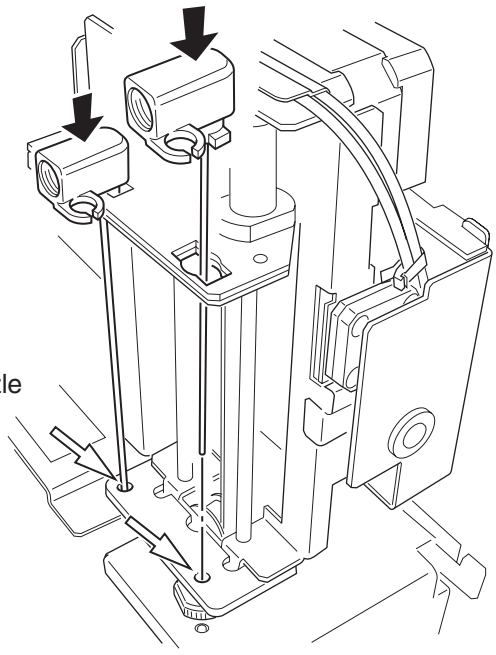
NOTE

Be careful not to drop the screws, tube holder and spacers into the hematology analyzer.



8. Remove the joint from the sampling nozzle.

9. Turn the sampling nozzle 90° counterclockwise and pull it up to remove it.



10. Insert the new sampling nozzle into the sampling nozzle guide, attach the joint and fasten the nozzle with the screw.

11. Reattach the front cover and fasten it with the two screws on each side.

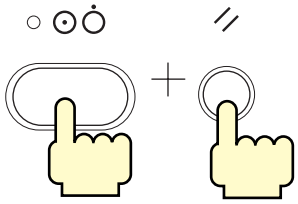
12. Turn the power on. The hematology analyzer starts priming the fluid path.

Checking and Cleaning the Cap Pierce Rinse Unit, Sampling Nozzle and Cap Pierce Needle (Optional MS-721V Cap Pierce Unit)

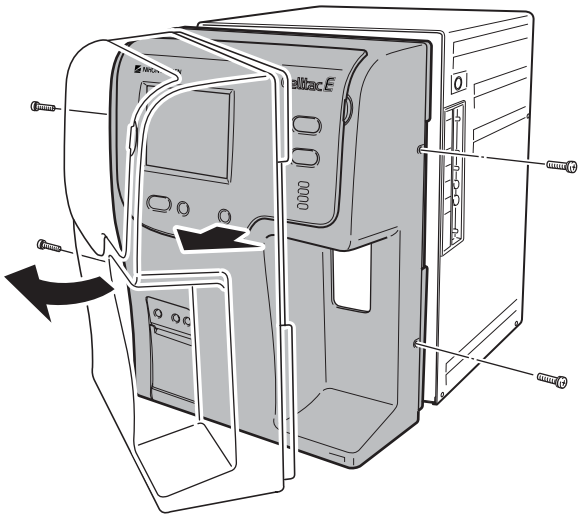
Check and clean dried blood and dirt on the cap pierce rinse unit, sampling nozzles and cap pierce needle every month or every 1000 sample countings.

1. Press the STRONG CLEAN key on the OPERATIONS screen to perform strong cleaning.

2. Press the DRAIN BATHS key on the OPERATIONS screen to drain the measurement baths and sub baths.



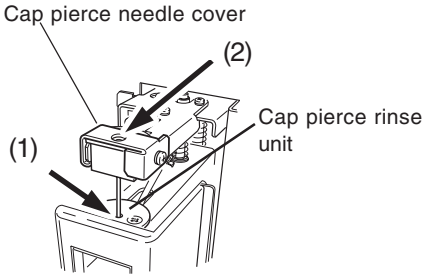
3. Press the Power key while holding down the Reset key to turn the power off. Check that the power lamp is off.



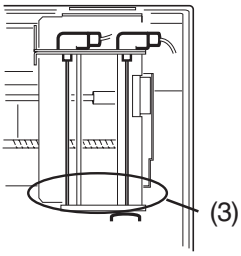
4. Remove the two screws on each side of the front cover of the hematology analyzer.

5. Open the front cover by pulling it from the right side.

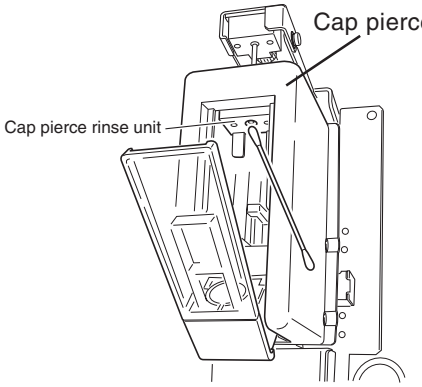
6. Check for dried blood or dirt on (1), (2), (3) and the bottom of the cap pierce rinse unit as shown below.



(1) Check for dirt around the opening of the cap pierce rinse unit
(2) Check for dirt around the opening of the cap pierce needle cover



(3) Check for dirt on the sampling nozzle (especially tip of the nozzle)



Wipe any dirt off (1), (2), (3) and the bottom of the cap pierce rinse unit with the cotton swab if there is dried blood or dirt.

NOTE

To remove crystals of blood or salt from the sampling nozzles, wipe them off with a gauze or a cotton swab moistened with CLEANAC•3 detergent.

7. Reattach the front cover and fasten it with the two screws on each side.

8. Turn the power on. The hematology analyzer starts priming the fluid path.

9. Display the OPERATION HISTORY screen and press the RESET key for NEEDLE to reset the counts to zero.

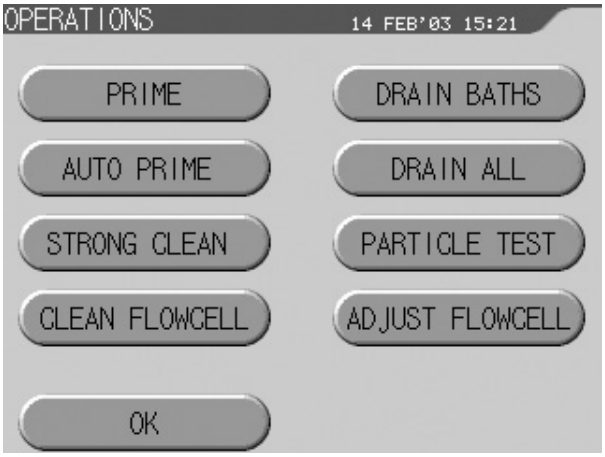
Checking and Replacing the Cap Pierce Needle (Optional MS-721V Cap Pierce Unit)

Check that there is no blood clot, dirt or damage on the cap pierce needle every month or every 1000 sample counts.

If there is any damage to the cap pierce needle, replace it with a new one according to the following procedure.

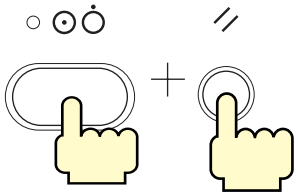
WARNING

The cap pierce needle is sharp and sample blood may have contacted it. Be careful not to prick yourself with the cap pierce needle.

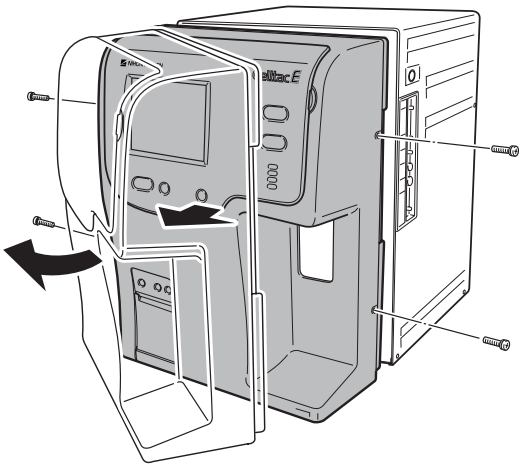


1. Press the STRONG CLEAN key on the OPERATIONS screen to perform strong cleaning.

2. Press the DRAIN BATHS key on the OPERATIONS screen to drain the measurement baths and sub baths.

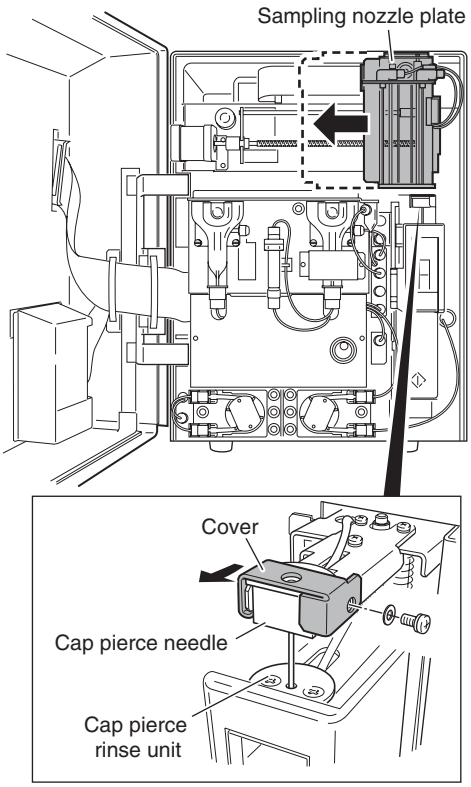


3. Press the power key while holding down the reset key to turn the power off. Check that the power lamp is off.



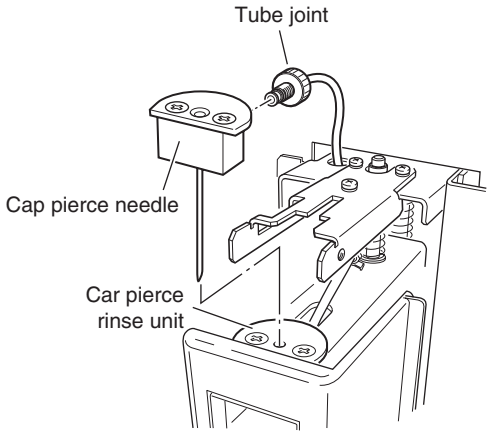
4. Remove the two screws on each side of the front cover of the hematology analyzer.

5. Open the front cover by pulling it from the right side.



6. Slide the sampling nozzle plate to the left.

7. Remove the screw from the cover.
   Pull the cover towards you and remove it from the cap pierce needle.



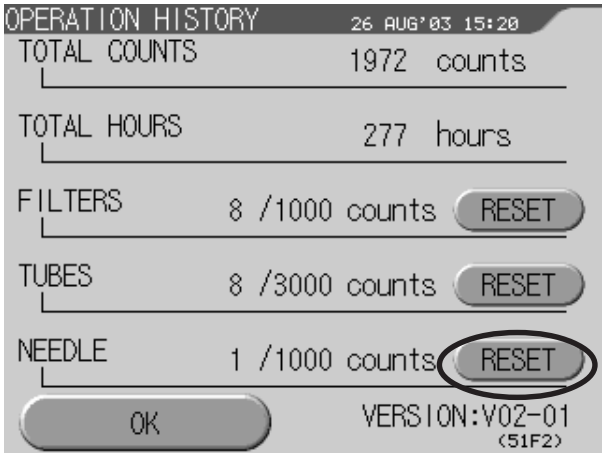
8. Pull the cap pierce needle upwards and remove it from the cap pierce rinse unit. Turn the tube joint counterclockwise and disconnect it from the cap pierce needle.

9. Replace the cap pierce needle with a new one.

10. Assemble the cap pierce needle cover and put back the sampling nozzle plate to its original position.

11. Reattach the front cover and fasten it with the two screws on each side.

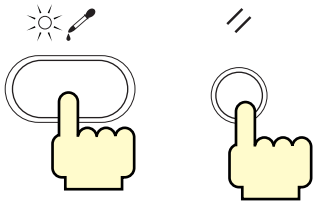
12. Turn the power on. The hematology analyzer starts priming the fluid path.



13. Display the OPERATION HISTORY screen and press the RESET key for NEEDLE to reset the counts to zero.

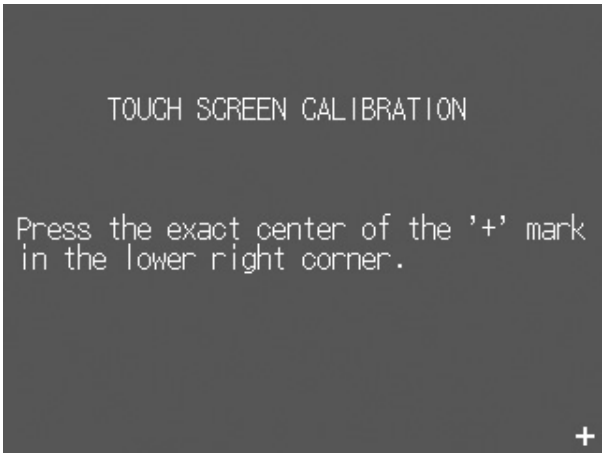
Calibrating Touch Screen

Calibrate the touch screen when the pressed position and operating position do not match.

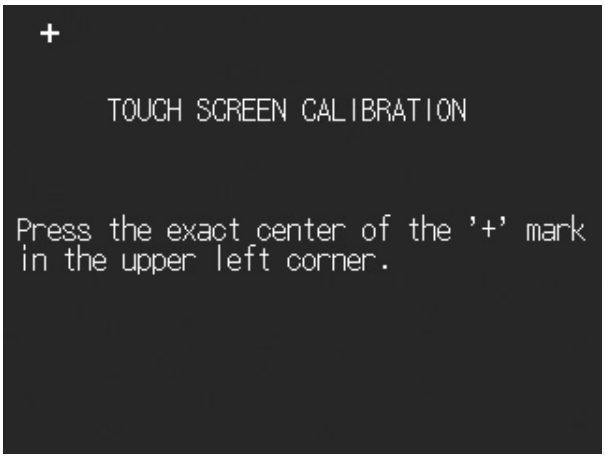


1. Press the Capillary mode key while holding down the Reset key.

   The TOUCH SCREEN CALIBRATION screen appears.



2. Follow the instructions on the screen to calibrate the screen.



NOTE

Do not use a sharp object to press the mark. Use your finger.

After calibration is completed, the screen returns to the READY screen.

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Maintenance Check Sheet

Fill out and save this check sheet each time you do maintenance or service.

Date: _____

Customer: _____

Customer Address: _____

Service Personnel: _____ Service Company: _____

Instrument Name: Hematology Analyzer Instrument Model: MEK-7222J ☐K ☐

Instrument Serial Number: _____ Hardware Revision: _____

Software Version: _____

Appearance

There is no damage on the hematology analyzer.	Yes	No
There is no fluid leakage on the hematology analyzer.	Yes	No

Safety

There is no damaged AC plug and exposed wire on the power cord.	Yes	No
3-pin plug type power cord is used and the 3 pins and plug housing are not deformed.	Yes	No
Resistance of the protective ground line of the power cord is 0.1 Ù or less.	Yes	No
Earth leakage current is 0.5 mA or less under normal condition.	Yes (mA)	No
Earth leakage current is 1.0 mA or less under each single fault condition.	Yes (mA)	No

Reagents

Nihon Kohden recommended diluent, detergent and hemolysing reagent are used.	Yes	No
ISOTONAC·3 diluent is not past the expiration date.	Yes	No
CLEANAC detergent is not past the expiration date.	Yes	No
CLEANAC·3 detergent is not past the expiration date.	Yes	No
HEMOLYNAC·3 or HEMOLYNAC·3N hemolysing reagent is not past the expiration date.	Yes	No
HEMOLYNAC·5 hemolysing reagent is not past the expiration date.	Yes	No

Cleaning/Replacing

Rinse unit is cleaned.	Yes	No
Cap pierce needle is cleaned.	Yes	No
Two filters are replaced with new ones.	Yes	No
Two pump tubes are replaced with new ones.	Yes	No
Sampling cup (Bath for WBC 5 part differential measurement) is cleaned.	Yes	No
Two sub baths and two measurement baths are cleaned.	Yes	No
Two aperture caps are cleaned.	Yes	No
Touch screen is cleaned with a soft cloth moistened with 80% alcohol.	Yes	No
Two sampling nozzles are cleaned or replaced with new ones if they are damaged or PLT background noise increases.	Yes	No

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SENSOR MONITOR screen

Write each sensor output voltage on the SENSOR MONITOR screen as follows:

- MANO UPPER: _____V under no fluid condition (Acceptable range: 3.5 V or more)
- MANO LOWER: _____V under no fluid condition (Acceptable range: 3.5 V or more)
- DILUENT: _____V under no fluid condition (Acceptable range: 3.5 V or more)
- HEMOLYNAC-5: _____V under no fluid condition (Acceptable range: 3.5 V or more)
- HEMOLYNAC-3: _____V under no fluid condition (Acceptable range: 3.5 V or more)
- MANO UPPER: _____V filled with fluid (Acceptable range: 1.5 V or less)
- MANO LOWER: _____V filled with fluid (Acceptable range: 1.5 V or less)
- DILUENT: _____V filled with fluid (Acceptable range: 1.5 V or less)
- HEMOLYNAC-5: _____V filled with fluid (Acceptable range: 1.5 V or less)
- HEMOLYNAC-3: _____V filled with fluid (Acceptable range: 1.5 V or less)
- HGB LED ON: _____V with fluid (Acceptable range: 1.5 V to 4.5 V)
- HGB LED OFF: _____V with no fluid (Acceptable range: 0.5 V or less)
- ELECTRODE: _____V filled with fluid (Acceptable range: 17.7 V to 18.3 V)
- MJ (Warmer temperature): _____°C filled with fluid
- CD (Temperature inside chassis): _____°C filled with fluid
- DILUTER CF: _____ (Compensation of dilution ratio)
- MEAS UNIT CF: _____ (Compensation of manometer volume)

CIRCUIT CHECK screen

Write each value on the CIRCUIT CHECK screen as follows:

- WBC: _____(Acceptable range: 8.0±5%)
- RBC: _____(Acceptable range: 1.6±5%)
- HGB ON: _____(Acceptable range: 1.5 V to 4.5 V)
- HGB OFF: _____(Acceptable range: 0.5 V or less)
- MCV: _____(Acceptable range: 100±15%)
- PLT: _____(Acceptable range: 160±5%)
- Sensitivity: WBC: (___), RBC: (___)
- Threshold: WBC: (___), RBC: (___), PLT: (___)

Background noise check

Write each value displayed on the screen after pressing the count switch:

- WBC: ____ (Acceptable range: 0.2 or less (x 10^3/ìL))
- RBC: ____ (Acceptable range: 0.05 or less (x 10^6/ìL))
- HGB: ____ (Acceptable range: 0.1 or less (g/dL))
- PLT: ____ (Acceptable range: 10 or less (x 10^3/ìL))
- TOC: ____ (Acceptable range: 100 or less)

Check with polymer microsphere suspensions

Write each value on the PARTICLE TEST screen when the polymer microsphere suspensions are aspirated with the sampling nozzle.

- FS CV%: ___ (Acceptable range: 7% or less)
- FS PEAK: ___
- FL CV%: ___ (Acceptable range: 7% or less)
- FL PEAK: ___
- TOC: ___

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Check with MEK-5DN Hematology Control

Write down the lot number of the MEK-5DN hematology control and all the X-R data on the X-R (NORMAL) screen when the hematology control is aspirated with the sampling nozzle.

Lot No. of MEK-5DN: _____

- WBC: X ____, R ____
- NE%: X ____, R ____
- LY%: X ____, R ____
- MO%: X ____, R ____
- EO%: X ____, R ____
- BA%: X ____, R ____
- RBC: X ____, R ____
- HGB: X ____, R ____
- HCT: X ____, R ____
- MCV: X ____, R ____
- MCH: X ____, R ____
- MCHC: X ____, R ____
- PLT: X ____, R ____

Current Calibration Coefficients

Write down the calibration coefficients as follows:

- WBC: ____ (Venous blood mode), ____ (Capillary blood mode)
- RBC: ____ (Venous blood mode), ____ (Capillary blood mode)
- HGB: ____ (Venous blood mode), ____ (Capillary blood mode)
- HCT: ____ (Venous blood mode), ____ (Capillary blood mode)
- PLT: ____ (Venous blood mode), ____ (Capillary blood mode)
- NE%: ____ (Venous blood mode)
- LY%: ____ (Venous blood mode)
- MO%: ____ (Venous blood mode)
- EO%: ____ (Venous blood mode)
- BA%: ____ (Venous blood mode)
- RDW: ____ (Venous blood mode)
- MPV: ____ (Venous blood mode)

New Calibration Coefficients

Write down the lot number of the MEK-3DN hematology control, new calibration coefficients and measured data as follows:

Lot No. of MEK-3DN: _____

	Venous blood		Capillary blood	
Parameter	**Measured data**	**Calibration coefficient**	**Measured data**	**Calibration coefficient**
WBC				
RBC				
HGB				
HCT				
PLT				
NE%				
LY%				
MO%				
EO%				
BA%				
RDW				
MPV				

Cut here

Software Version

Write down the software version on the OPERATION HISTORY screen:

Software version: _____

Operations

Touch screen function is checked.	Yes	No
Date and time settings are checked.	Yes	No
Automatic cleaning operations are normal during this maintenance check.	Yes	No
There is no fluid leakage on the hematology analyzer.	Yes	No
Constant volume of the diluent is properly dispensed when pressing the Dispense/Open key on the front panel in capillary blood mode.	Yes	No
Cap pierce unit properly works when the cap pierce unit is installed and the Open mode or Closed mode is selected.	Yes	No

Built-in Printer Unit Operation (When the printer is installed)

Pressing the Feed key on the front panel feeds the recording paper and there is no dot missing on the paper by pressing the Print key on the front panel.	Yes	No

External Printer Unit Operation (When the external printer is connected)

Paper feed operation properly works on the external printer and there is no dot missing on the paper.	Yes	No

Bar Code Reader Operation (When the bar code reader is installed)

Light emitter and detector parts are cleaned with a cotton swab moistened with 80% alcohol.	Yes	No
Bar code reading operation properly works.	Yes	No

Others

Write down any other points on this sheet.

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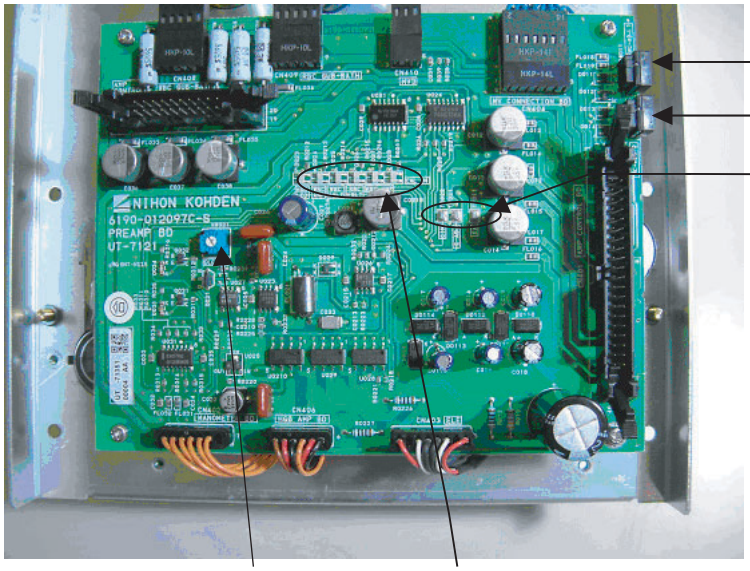
Section 7 Test point, Variable Resister, LED and Switch on Board

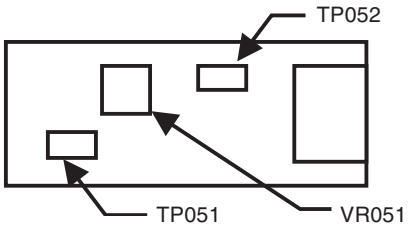
PRE AMP board 7.1
HGB AMP board 7.2
MANOMETER board 7.2
MV CONNECTION board 7.3
4WAY LIQUID SENSOR board 7.4
SHEATH board 7.5
TRIPLE PUMP board 7.6
DILUTER DRIVER board 7.7
SAMPLER-X board 7.8
SAMPLER-Z board 7.8
KEY DISPLAY board 7.9
VOLUME board 7.9
POWER board 7.10
AMP CONTROL board 7.12
DRIVER board 7.14

PRE AMP board



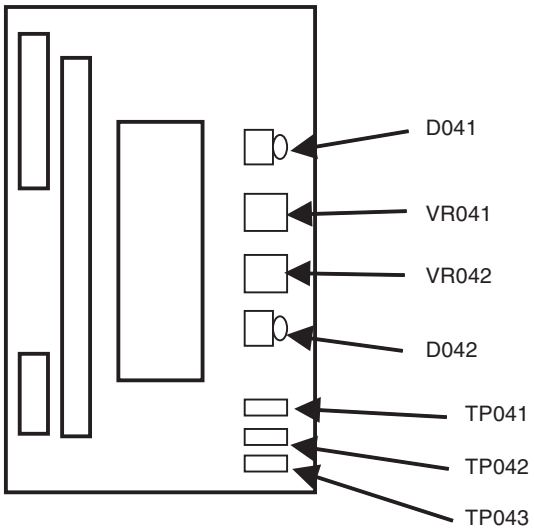
TP011[EA] : Ground terminal for analog circuit
TP021[C ADJ] : Test point for circuit check operation
TP022[CIN] : Test point for blood cell pulse operation
VR021[ELE VR] : Variable resistor for adjustment of voltage between the electrodes
D023[HGB LDE] : LED for operation check of the HGB LED. When the HGB LED is lit, this LED is also lit.
D024[WBC AMP] : LED for operation check of WBC measurement circuit selection. When the circuit is selected, this LED is lit.
D025[WBC VOLT] : LED for operation check of WBC high voltage circuit selection. When the circuit is selected, this LED is lit.
D026[RBC VOLT] : LED for operation check of RBC high voltage circuit selection. When the circuit is selected, this LED is lit.
D027[RBC AMP] : LED for operation check of RBC measurement circuit selection. When the circuit is selected, this LED is lit.
D028[CAL ON] : LED for operation check of circuit check pulse selection. When the circuit check pulse is selected, this LED is lit.
SW011[MC-ADJ.1] : Switch for compensation of the manometer. This switch is used for the second digit of the two-digit compensation value.
SW012[MC-ADJ.2] : Switch for compensation of the manometer. This switch is used for the first digit of the two-digit compensation value.

HGB AMP board



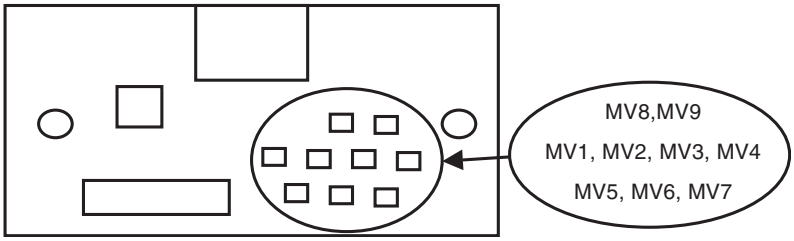
TP051[EA] : Ground terminal for analog circuit.
TP052[HANA] : Test point for output voltage from HGB sensor.
VR051[HGB VR] : Variable resistor for adjustment of output voltage from HGB sensor

MANOMETER board



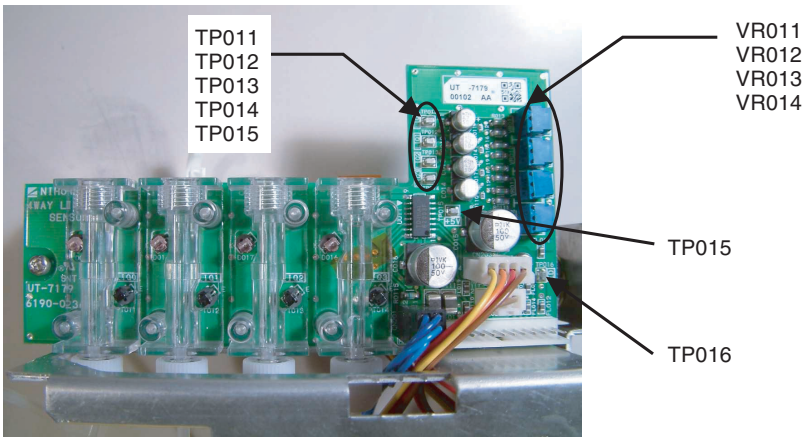
TP041[UPE] : Test point for output voltage from the optical sensor at the upper part of the manometer
TP042[LOWE] : Test point for output voltage from the optical sensor at the lower part of the manometer
TP043[ED] : Ground terminal for digital circuit
VR041[UP VR] : Variable resistor for adjustment of output voltage from optical sensor at the upper part of the manometer
VR042[LOW VR] : Variable resistor for adjustment of output voltage from optical sensor at the lower part of the manometer
D041[UPER] : LED for operation check of optical sensor at the upper part of the manometer. When the fluid level is higher than the upper sensor, this LED is lit.
D042[LOWER] : LED for operation check of optical sensor at the lower part of the manometer. When the fluid level is higher than the lower sensor, this LED is lit.

MV CONNECTION board



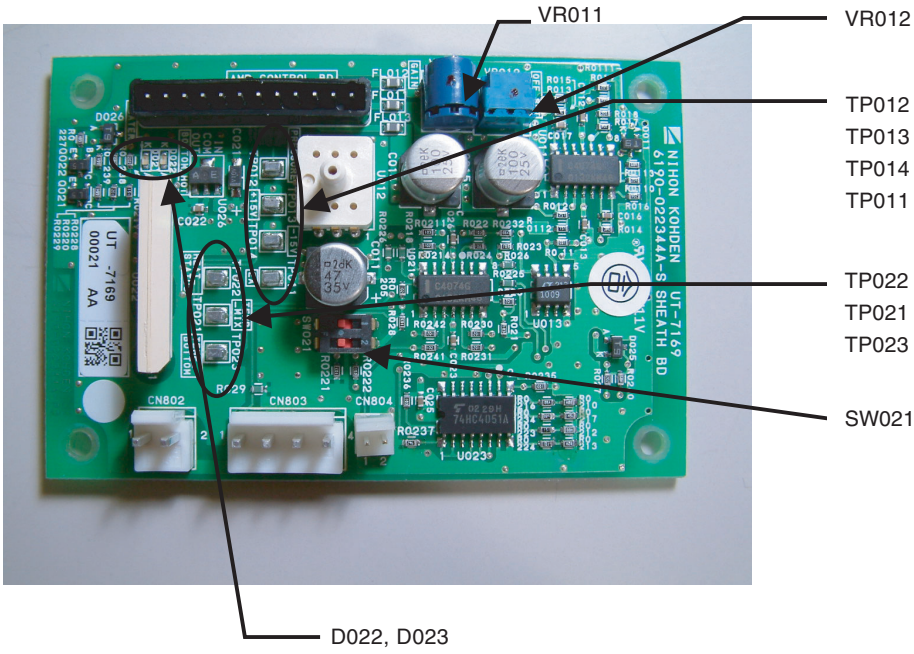
D061[MV1] : LED for operation check of MV1 valve. When the MV1 works, this LED lights.
D062[MV2] : LED for operation check of MV2 valve. When the MV2 works, this LED lights.
D063[MV3] : LED for operation check of MV3 valve. When the MV3 works, this LED lights.
D064[MV4] : LED for operation check of MV4 valve. When the MV4 works, this LED lights.
D065[MV5] : LED for operation check of MV5 valve. When the MV5 works, this LED lights.
D066[MV6] : LED for operation check of MV6 valve. When the MV6 works, this LED lights.
D067[MV7] : LED for operation check of MV7 valve. When the MV7 works, this LED lights.
D068[MV8] : LED for operation check of MV8 valve. When the MV8 works, this LED lights.
D069[MV9] : LED for operation check of MV9 valve. When the MV9 works, this LED lights.

4WAY LIQUID SENSOR board



TP011[LIQ0] : Test point for output voltage from sensor for diluent and detergent
TP012[LIQ1] : Test point for output voltage from sensor for hemolysing reagent HEMOLYNAC5
TP013[LIQ2] : Test point for output voltage from sensor for hemolysing reagent HEMOLYNAC3
TP014[LIQ3] : Test point for output voltage from sensor in the sheath unit.
TP015[+5V] : +5 V DC terminal for digital circuit.
TP016[ED] : Ground terminal for digital circuit.
VR011[LIQ0] : Variable resistor for adjustment of output voltage from sensor for diluent and detergent.
VR012[LIQ1] : Variable resistor for adjustment of output voltage from sensor for HEMOLYNAC5 reagent
VR013[LIQ2] : Variable resistor for adjustment of output voltage from sensor for HEMOLYNAC3 reagent
VR014[LIQ3] : Variable resistor for adjustment of output voltage from sensor in the sheath unit.

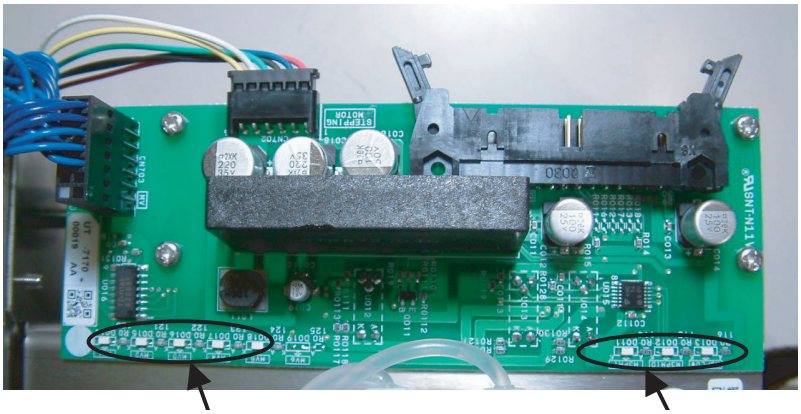
SHEATH board



TP011[EA] : Ground terminal for analog circuit
TP012[PRESSURE] : Test point for output voltage from pressure sensor.
TP013[+15V] : Test point for +15 V DC for analog circuit.
TP014[-15V] : Test point for -15 V DC for analog circuit.
TP021[TEMP_MIX] : Test point for temperature inside the mix chamber.
TP022[HEAT_STATUS] : Test point for heater operation
TP023[TEMP_BOTTOM] : Test point for environmental temperature at the bottom of the instrument.
VR011[GAIN] : Variable resistor for gain adjustment of pressure sensor.
VR012[OFF SET] : Variable resistor for offset adjustment of pressure sensor.
D021[HEATER] : LED for operation check of the heater. When the heater works, this LED lights.
D022[BOTTOM HOT] : LED for operation check in high environmental temperature. When the temperature control works, the LED lights.
SW021 : Switch for temperature setting. See the following table

Bit switch setting Combination		Bit 1	
		OFF	ON
Bit 2	OFF	Default: When the environmental temperature is 15 to 23°C, temperature in the mix chamber is set to 36.3°C. When the environmental temperature is 23°C or higher, temperature in the mix chamber is set to 30°C.	Temperature in the mix chamber is fixed to 36.3°C.
	ON	When the environmental temperature is 15 to 23°C, temperature in the mix chamber is set to 34.1°C. When the environmental temperature is 23 to 28°C, temperature in the mix chamber is set to 28°C.	Temperature in the mix chamber is fixed to 34.1°C.

TRIPLE PUMP board

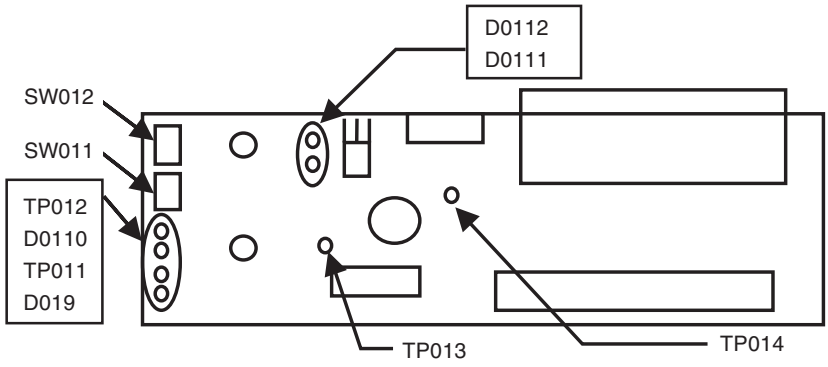


D014, D015, D016, D017, D018,

D011, D012, Do13

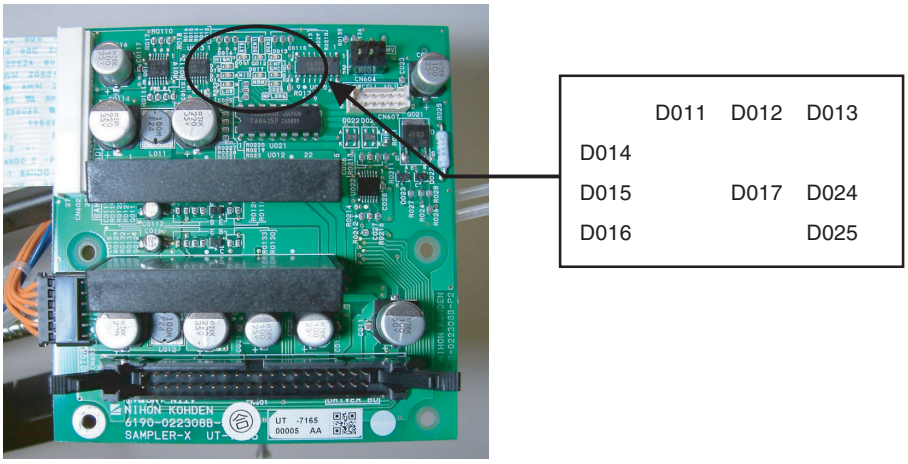
D011[HCPHI] : LED for operation check of the high position sensor. When the sensor is turned on, this LED is lit.
D012[HCPMID] : LED for operation check of the middle position sensor. When the sensor is turned on, this LED is lit.
D013[HCPLOW] : LED for operation check of the low position sensor. When the sensor is turned on, this LED is lit.
D014[MV1] : LED for operation check of the MV1 valve. When the valve is turned on, this LED is lit.
D015[MV2] : LED for operation check of the MV2 valve. When the valve is turned on, this LED is lit.
D016[MV3] : LED for operation check of the MV3 valve. When the valve is turned on, this LED is lit.
D017[MV4] : LED for operation check of the MV4 valve. When the valve is turned on, this LED is lit.
D018[MV5] : LED for operation check of the MV5 valve. When the valve is turned on, this LED is lit.

DILUTER DRIVER board



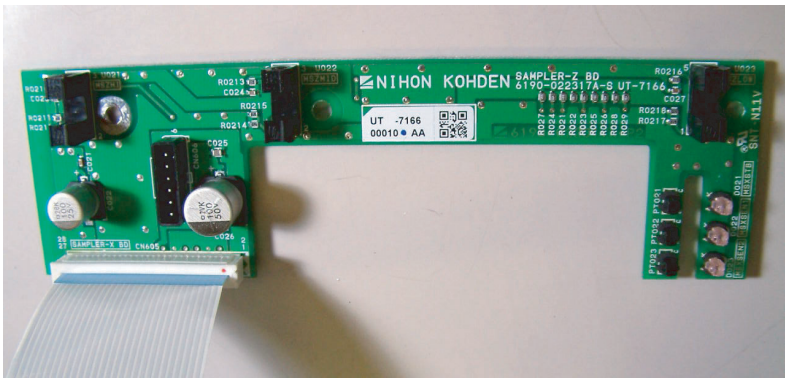
TP011[ORIGIN] : Test point for output voltage from the home position sensor for the piston of the diluter.
TP012[ENCODE] : Test point for output voltage from the position encoder for the piston of the diluter.
TP013[ED] : Ground terminal for digital circuit
TP014[+5V] : Test point for +5 V DC for digital circuit
SW011[DIL.ADJ.2] : Switch for compensation of the diluter. This switch is used for the first digit of the two-digit compensation value.
SW012[DIL.ADJ.1] : Switch for compensation of the diluter. This switch is used for the second digit of the two-digit compensation value
D019[ENCODE] : LED for operation check of the position encoder for the piston of the diluter. When the encoder is turned on, this LED is lit.
D0110[ORIGIN] : LED for operation check of the home position sensor for the piston of the diluter. When the sensor is turned on, this LED in lit.
D0111[MD1MV] : LED for operation check of the MV1 valve. When the valve is turned on, this LED is lit.
D0112[MD2MV] : Reserved. (LED for operation check of the MV2 valve. When the valve is turned on, this LED is lit.)

SAMPLER-X board



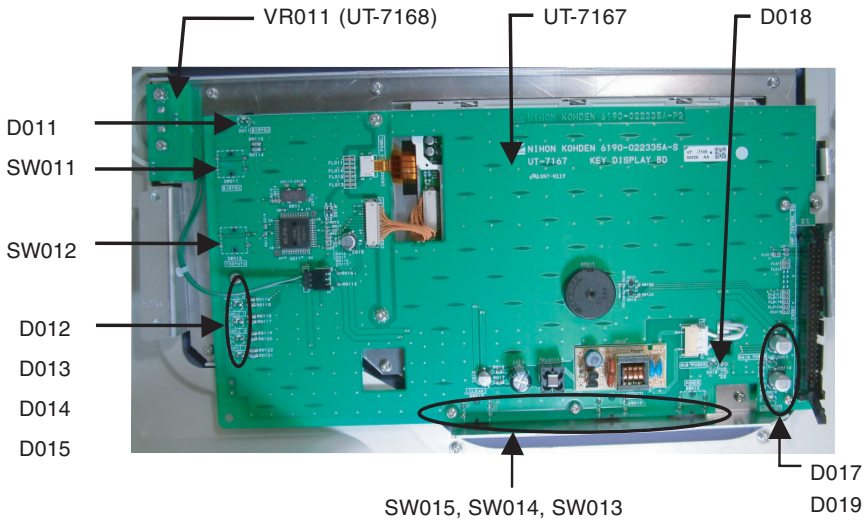
D011[STB] : LED for operation check of standby position sensor on the X-axis. When the sensor is turned on, the LED is lit.
D012[SEN1] : LED for operation check of the position sensor 1 on the X-axis. When the sensor is turned on, the LED is lit.
D013[SEN2] : LED for operation check of the position sensor 2 on the X-axis. When the sensor is turned on, the LED is lit.
D014[HIGH] : LED for operation check of the high position. When the sensor is turned on, this LED is lit.
D015[MID] : LED for operation check of the middle position. When the sensor is turned on, this LED is lit.
D016[LOW] : LED for operation check of the low position. When the sensor is turned on, this LED is lit.
D017[MSMV] : LED for operation check of the valve. When the valve is turned on, this LED is lit.
D024[MFLENCD] : Reserved (LED for operation check of the position encorder for MA-720V flow cell adjuster. When the encoder is turned on, this LED is lit.)
D025[MFLORG] : LED for operation check of the original position sensor for MA-720V flow cell adjuster. When the sensor is turned on, this LED is lit.

SAMPLER-Z board



There is no test point

KEY DISPLAY board

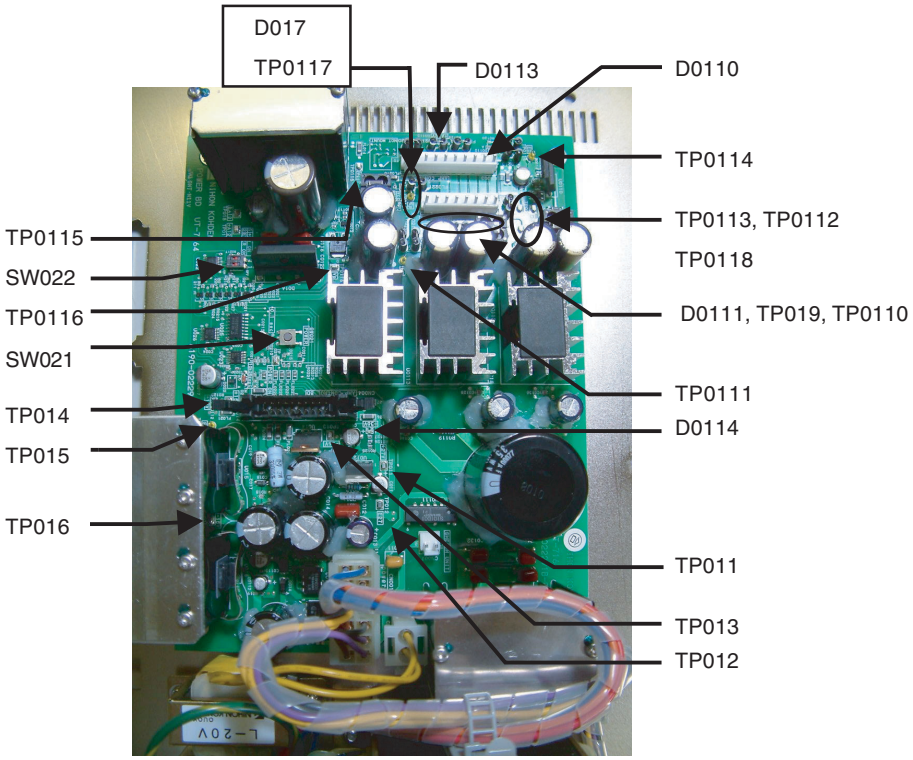


D011[BIRYOU] : LED for capillary mode operation. When the instrument is in the capillary mode, this LED is lit.
D012[SAMPLE 0] : LED for operation indication. When the instrument is in standby mode, this LED is lit.
D013[SAMPLE 1] : LED for operation indication. When the instrument is in standby mode, this LED is lit.
D014[SAMPLE 2] : LED for operation indication. When the instrument is in standby mode, this LED is lit.
D015[SAMPLE 3] : LED for operation indication. When the instrument is in standby mode, this LED is lit.
D017[MAIN POWER] : LED for status indication of the main power switch. When the main power switch is set to on, this LED is lit.
D018[SUB POWER] : LED for status indication of the Power key When the Power key is pressed, this LED is lit.
D019[LASER KEY] : LED for status indication of the laser switch. When the laser switch is set to on, this LED is lit.
SW011[BIRYOU] : Capillary mode switch
SW012[TOSYUTU] : Diluent dispense switch in capillary mode.
SW013[POWER] : Power key
SW014[RESET] : Reset key
SW015[CLEAN] : Clean key

VOLUME board

VR012[OFF SET] : Variable resistor for offset adjustment of pressure sensor.

POWER board

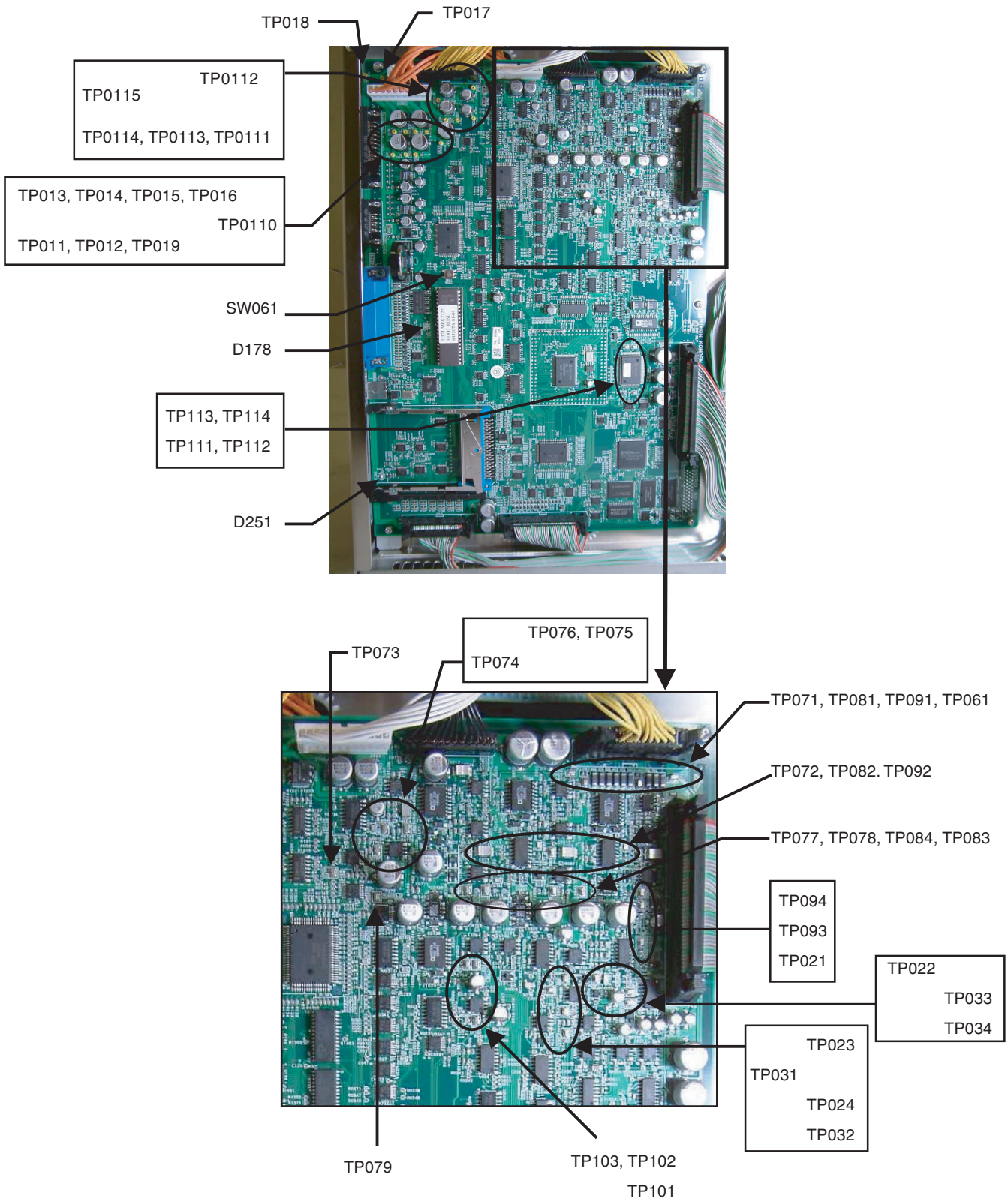


TP011[+27V] : +27 V DC terminal for LCD
TP013[-36V] : -36 V DC terminal for analog circuit.
TP014[+15V] : +15 V DC terminal for analog circuit.
TP015[EA] : Ground terminal for analog circuit.
TP016[-15V] : -15 V DC terminal for analog circuit
TP017[+A12V] : +12 V DC for analog circuit
TP018[EA12] : Ground terminal for +12 V DC use analog circuit
TP019[Vu] : Supply voltage (Vu) terminal for motor control
TP0110[+12V] : +12 V DC terminal for valve control
TP0112[+5V] : +5 V DC terminal for digital circuit
TP0113[+3.3V] : +3.3 V DC terminal for digital circuit
TP0114[ED] : Ground terminal for digital circuit
TP0115[Vcc] : Supply voltage (Vcc) terminal for secondary power circuit control
TP0116[Vp] : Supply voltage (Vp) terminal for optional built-in type printer unit.
TP0117[Ep] : Ground terminal for optional built-in type printer unit.
TP0118[E12] : Ground terminal for valve control
TP0111[Eu] : Ground terminal for motor control
TP021[POWER ON] : Test point for power off control signal
D017[Vcc] : LED for supply voltage check for secondary power circuit control. When the voltage is supplied to the circuit, this LED is lit.
D0110[+5V] : Test point for +5 V DC for digital circuit. When the +5 V DC is supplied to the digital circuit, this LED is lit.
D0111[Vu] : LED for check of supply voltage for motor control. When the voltage is supplied to the motor control circuit, this LED is lit.

D0112[+15V] : LED for check of +15 V DC for analog circuit. When the +15 V DC is supplied to the analog circuit, this LED is lit.
D0113[+A12V] : LED for check of +12 V DC for analog circuit. When the voltage is supplied to the analog circuit, this LED is lit.
D0114[-36V] : LED for check of -36 V DC for analog circuit. When the voltage is supplied to the analog circuit, this LED is lit.
SW021[POEWR] : Power switch
SW022 : Bit switches for power supply mode selection. See the following table.

Bit switch	Default	Operation when the bit switch is set to ON.
No. 1	OFF	When the main power switch is turned on, only +5 V DC is live.
No. 2	OFF	When the main power switch is turned on, the -36 V, ±15 V, +12 V, +A12 V, +27 V, Vu and Vp supply voltages are live.

AMP CONTROL board

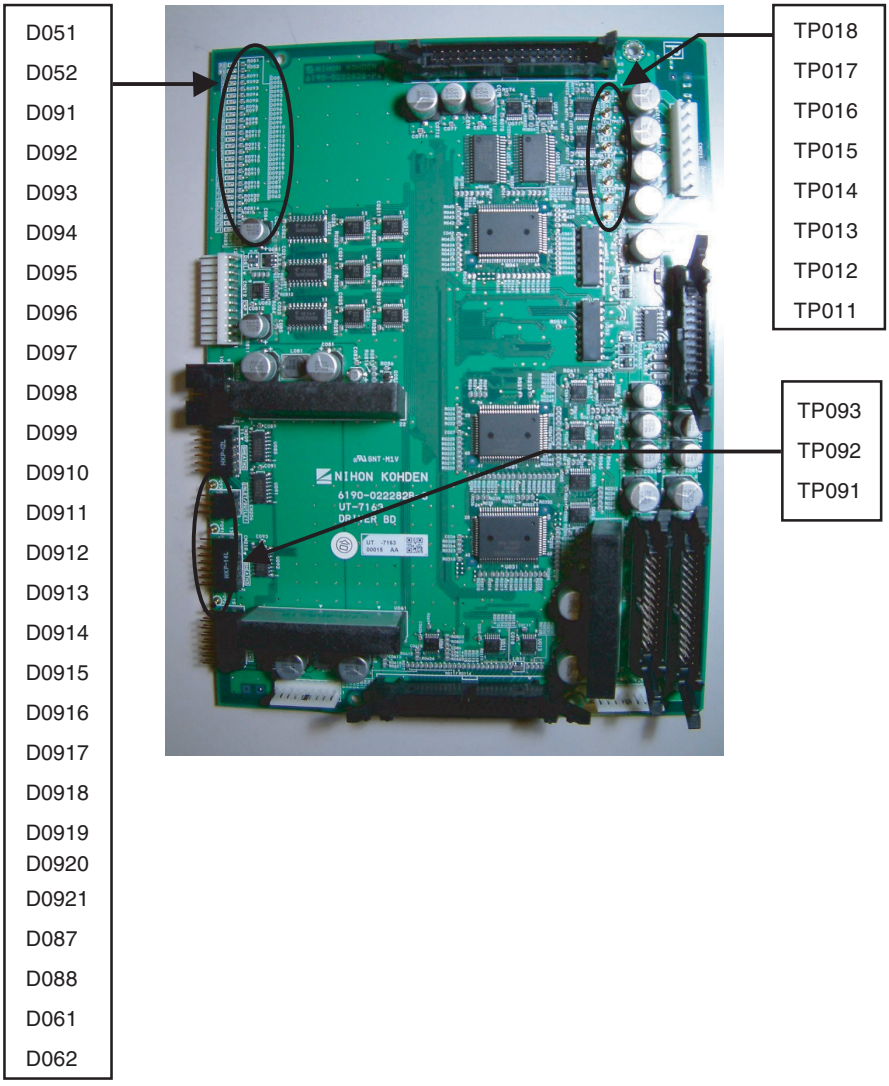


TP011[+5V] : +5 V DC terminal for digital circuit
TP012[ED] : Ground terminal for digital circuit
TP013[+12V] : +12 V DC terminal for valve control
TP014[E12] : Ground terminal for valve control
TP015[+A12V] : +12 V DC terminal for analog circuit

TP016[EA12] : Ground terminal for +12 V DC supplied to analog circuit
TP017[Vp] : Supply voltage (Vp) terminal for optional built-in printer
TP018[Ep] : Ground terminal for optional built-in printer
TP019[Vcc] : Supply voltage (Vcc) for secondary power circuit control
TP0110[+3.3V] : +3.3 V DC terminal for digital circuit
TP0111[-36V] : -36 V DC terminal for analog circuit
TP0112[+27V] : +27 V DC terminal for LCD
TP0113[-15V] : -15 V DC terminal for analog circuit
TP0114[EA] : Ground terminal for analog circuit
TP0115[+15V] : +15 V DC termial for analog circuit
TP021[CIN] : Test point for blood cell pulses from MC-720V CBC measuring unit
TP022[CFIL] : Test point for output waveform through the low-pass filter
TP023[RB] : Test point for output waveform from the Robinson gate circuit
TP024[CLOUT] : Test point for output waveform from baseline stabilizer circuit
TP031[PEAK HOLD] : Test point for output waveform from the peak-hold circuit
TP032[CANA] : Test point for output waveform from the gain setting circuit
TP033[LOW THR] : Test point for lower threshold level
TP034[HIGH THR] : Test point for upper threshold level
TP061[+VLD] : Test point for laser operation
TP071[ANA1] : Test point for output waveform for FS (channel 1) from MO-820V laser optical unit
TP072[FIL1] : Test point for output waveform through the low-pass filter for FS (channel 1)
TP073[GATE] : Test point for output waveform from the gate circuit for 5-part differential WBC
TP074[RBP] : Test point for output waveform of Robinson gate pulse for 5-part differential WBC
TP075[RB1] : Test point for output waveform from the Robinson gate circuit for 5-part differential WBC
TP076[RBTHR] : Test point for threshold level on the Robinson gate circuit for 5-part differential WBC
TP077[PHA1] : Test point for output waveform from the peak-hold circuit for FS (channel 1)
TP078[CL1] : Test point for output waveform from the baseline stabilizer circuit for FS (channel 1)
TP079[PEAK-HOLD] : Test point for the peak-hold control signal for 5-part differential WBC
TP081[ANA2] : Test point for output waveform for FL (channel 2) from MO-820V laser optical unit
TP082[FIL2] : Test point for output waveform through the low-pass filter for FL (channel 2)
TP083[CL2] : Test point for output waveform from the baseline stabilizer circuit for FL (channel 2)
TP084[PHA2] : Test point for output waveform from the peak-hold circuit for FL (channel 2)
TP091[ANA3] : Test point for output waveform for SD (channel 3) from MO-820V laser optical unit
TP092[FIL3] : Test point for output waveform through the low-pass filter for SD (channel 3)

TP093[CL3] : Test point for output waveform from the baseline stabilizer circuit for SD (channel 3)
TP094[PHA3] : Test point for output waveform from the peak-hold circuit for SD (channel 3)
TP101[PKD] : Test point for peak detection pulse of 5-part differential WBC
TP102[ANA1-THL] : Test point for threshold level of 5-part differential WBC
TP103[THP] : Test point for threshold pulse of 5-part differential WBC
TP111 : Test point for operation check of 5-part differential WBC (A/D BUSY)
TP112 : Test point for operation check of 5-part differential WBC (IRQ1CK)
TP113 : Test point for operation check of 5-part differential WBC (IRQ1RS)
TP114 : Test point for operation check of 5-part differential WBC (IRQ1EN)
D178[POWER] : LED for status indication of power supply to this board. When the power is supplied to the board, this LED is lit.
D251[CARD IN] : LED for status indication of memory card insertion. When the card is inserted into the slot of the instrument, this LED is lit.
SW061[RESET] : Reset switch for this board

DRIVER board



TP011[+5V] : +5V DC terminal for digital circuit
TP012[ED] : Ground terminal for digital circuit
TP013[+12V] : +12 V DC terminal for valve control
TP014[E12] : Ground terminal for valve control
TP015[+A12V] : +12 V DC terminal for analog circuit
TP016[EA12] : Ground terminal for +12 V DC (+A12V) supplied analog circuit
TP017[Vu] : Supply voltage (Vu) for motor control
TP018[Eu] : Ground terminal for motor control
TP091 : Test point for protection to a wrong connector connection
TP092 : Test point for protection to a wrong connector connection
TP093 : Test point for protection to a wrong connector connection
D051[RS] : LED for operation check of the RBC sub bath in the MC-720V CBC measuring unit. When the RBC sub bath works, this LED lights.
D052[WS] : LED for operation check of the WBC sub bath in the MC-720V CBC measuring unit. When the WBC sub bath works, this LED lights.
D061[P2] : LED for operation check of sensor 2 in the MP-520V pump unit. When the sensor is turned on, this LED is lit.
D062[P1] : LED for operation check of sensor 1 in the MP-520V pump unit. When the sensor is turned on, this LED is lit.
D087[C1] : LED for operation check of valve 1 in the MS-721V cap pierce unit. When the valve is turned on, this LED is lit.
D088[C2] : LED for operation check of valve 2 in the MS-721V cap pierce unit. When the valve is turned on, this LED is lit.
D091[1] : LED for operation check of valve 1 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D092[2] : LED for operation check of valve 2 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D093[3] : LED for operation check of valve 3 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D094[4] : LED for operation check of valve 4 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D095[5] : LED for operation check of valve 5 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D096[6] : LED for operation check of valve 6 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D097[7] : LED for operation check of valve 7 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D098[8] : LED for operation check of valve 8 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D099[9] : LED for operation check of valve 9 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D0910[10] : LED for operation check of valve 10 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D0911[11] : LED for operation check of valve 11 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D0912[12] : LED for operation check of valve 12 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D0913[13] : LED for operation check of valve 13 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.

D0914[14] : LED for operation check of valve 14 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D0915[15] : LED for operation check of valve 15 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D0916[16] : LED for operation check of valve 16 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D0917[17] : LED for operation check of valve 17 in the MJ-721V sheath unit. When the valve is turned on, this LED is lit.
D0918[E1] : LED for operation check of spare valve 1. When the valve is turned on, this LED is lit.
D0919[J3] : LED for operation check of valve 3 in the MJ-720V inlet/outlet unit. When the valve is turned on, this LED is lit.
D0920[J4] : LED for operation check of valve 4 in the MJ-720V inlet/outlet unit. When the valve is turned on, this LED is lit.
D0921[E2] : LED for operation check of spare valve 2. When the valve is turned on, this LED is lit.

Section 8 Demonstration Guide

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Introduction

This demonstration guide provides an installation and setup flow chart for a demonstration of the MEK-7222J/K hematology analyzer.

The installation takes approximately 2 hours. Copy the check sheet provided at the end of this manual and use it for checks. It is also useful in troubleshooting.

Demonstration Outline

Do the following steps to install and set up the hematology analyzer for demonstration.

1. Prepare the hematology analyzer.
   a) Connect the tubes.
   b) Connect the power cord and ground the hematology analyzer.
   c) Turn the laser switch on.
   d) Turn on the power.

2. Set the settings and clean the fluid path in the hematology analyzer.
   a) Check and set the date and time settings.
   b) Clean the fluid path in the hematology analyzer by pressing the clean key on the front panel.

3. Adjust the gain and measure background noise
   a) Count the polymer microsphere suspensions to check the CV and PEAK values.
   b) Adjust the flow cell unit position.
   c) Adjust the gain (FS and FL) for WBC 5 part differential parameters in rough mode using polymer microsphere suspensions.
   d) Measure background noise.
   e) Adjust gain for WBC 5 part differential parameters in fine mode using venous blood samples from different healthy people which are 30 minutes to 8 hours after collection.
   f) Check the actual peak list for all samples to see if the gain is adjusted appropriately. Make sure that the average peak of MO is optimum.

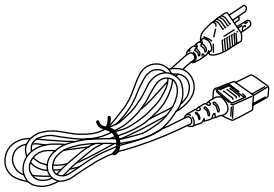
4. Calibrate the hematology analyzer.
   a) Perform calibration measurement with MEK-3DN calibrator to obtain a mean value for calculating the new calibration coefficient. The MEK-3DN calibrator can be used as a calibrator if it is stored at 2 to 8°C and is used within 3 days after opening. To ensure higher accuracy, use the calibrator soon after opening.
   b) Perform the calibration for CBC parameters (WBC, RBC, HGB, MCV, PLT, RDW, MPV).
   c) Check that the calibration coefficients for WBC 5 part differential parameters (LY%, MO%, EO%, BA%) are 1,000 on the CALIBRATION

screen. In the gain adjustment performed in step 3, WBC 5 part differential parameters are already accurately calibrated. Therefore, you only need to check the calibration coefficient.

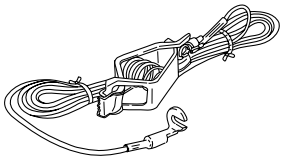
5. Check the following data.
   a) Measure the MEK-5DN/H/L hematology control and check that the obtained data falls within the acceptable range on the assay sheet attached to the hematology control.
   b) Count more than 10 venous blood samples of different healthy people which are 30 minutes to 8 hours after collection and make sure that there is no flag such as “Left Shift”, “Eosinophilia”, “Blasts”, “Immature Granulocyte”, or “Atypical Lymphocytes” displayed.

Required Items for Demonstration

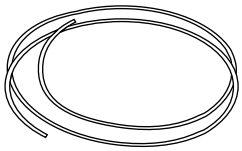
Make sure that you have the following necessary items for the demonstration. These are provided with the hematology analyzer. The number in the parentheses indicates the necessary quantity.



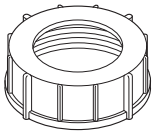
Power cord (1)



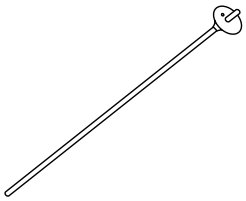
Ground lead (1)



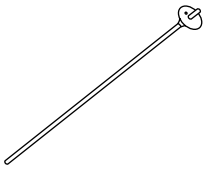
Waste tube (1), CLEANAC tube (1), ISOTONAC tube (1)



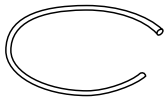
18 L cap (3)



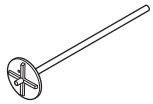
18 L diluent tube assy (1)



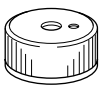
18 L diluent tube assy 8 WASTE (1)



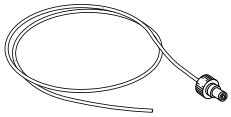
Cleanac tube 8 for CLEANAC•3 (1)



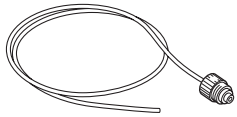
Cleanac tube assy 8222 (2)



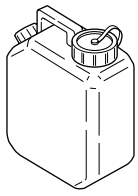
Hemolynac3 cap (2)



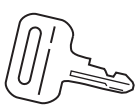
Hemolynac•3 tube assy (1)



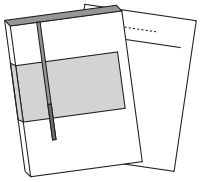
Hemolynac•5 tube assy (1)



Waste container (1)



Laser key (2)



Manuals (1 set)

The following items are also required.

- Diluent ISOTONAC•3, MEK-640
- Detergent CLEANAC, MEK-520
- Detergent CLEANAC•3, MEK-620
- Hemolysing reagent HEMOLYNAC•3, MEK-660, or HEMOLYNAC•3N, MEK-680
- Hemolysing reagent HEMOLYNAC•5, MEK-910
- 7 µm polymer microsphere suspensions, YZ-0194 (supply code no. T905)
- Hematology control, MEK-3DN
- Hematology control, MEK-5DN/H/L
- Sample containers
- Wiping cloth (tissue papers)
- Rubber or latex gloves
- Distilled water
- Cleaning bottle kit, YZ-0252
- 15 blood samples from different healthy people

Preparing the Hematology Analyzer

Installation Flowchart

1. Connect the diluent, detergent, hemolysing reagent and waste containers to the hematology analyzer.
2. Connect the power cord and perform grounding, if necessary.
3. Turn the laser switch on the right side panel to on for WBC 5 part differential measurement.
4. Turn on the power of the hematology analyzer.

Connecting Tubes

Connect the following reagent bottles and waste container.

- Waste container
- Diluent ISOTONAC•3
- Detergent CLEANAC•3
- Detergent CLEANAC
- Hemolysing reagent HEMOLYNAC•3 or HEMOLYNAC•3N
- Hemolysing reagent HEMOLYNAC•5

Tubes and caps necessary for connecting the reagents and container and the inlets and outlets to which these reagents and container are to be connected are indicated in the following illustration and table. For details, refer to the operator's manual.

CAUTION

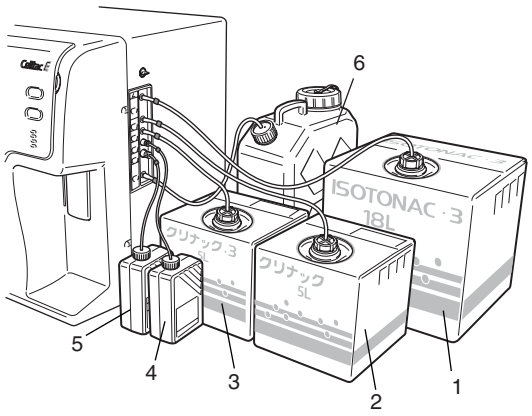
Avoid reagents or waste fluid contact with the skin. If it contacts the skin or eyes or is swallowed, wash thoroughly with water and see a physician immediately.

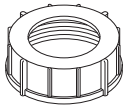
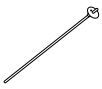
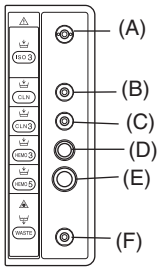
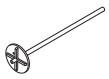
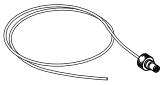
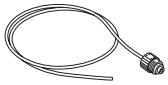
NOTE

- **Be careful not to let dust get in the hemolysing reagent, diluent or detergent.**
- **When using the diluent container, detergent container or waste container, follow the instructions on each package.**
- **Place the diluent and detergent containers at the same level as the hematology analyzer.**
- **Do not squeeze or bend the tubes. Otherwise the hematology analyzer may be damaged.**
- **If necessary, cut the tube to an appropriate length if it does not fit.**
- **Only use the specified detergent tubes for the detergent.**
- **When using HEMOLYNAC•3N reagent after using HEMOLYNAC•3 reagent, calibrate the hematology analyzer after changing the reagent. Otherwise the hemoglobin concentration decreases.**

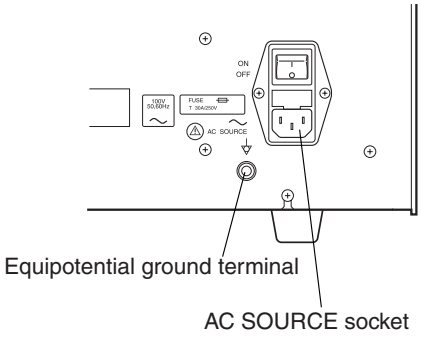
- **When using HEMOLYNAC•3N reagent, attach the HEMO3N label provided with the hematology analyzer to cover the HEMO3 label at the HEMO3 inlet.**

Refer to “Connecting tubes” in section 2 of the MEK-7222 operator’s manual.



Reagent/Container		Cap	Tube/Tube ASSY		Inlet/Outlet on the hematology analyzer	
1	Diluent ISOTONAC•3	18 L cap 	18 L diluent tube assy 	ISOTONAC tube	ISO3 Inlet (A)	
2	Detergent CLEANAC		Cleanac tube assy (8222) 	CLEANAC tube	CLN Inlet (B)	
3	Detergent CLEANAC•3			Cleanac tube 8	CLN3 Inlet (C)	
4	Hemolysing reagent HEMOLYNAC•3 or HEMOLYNAC•3N	Hemolynac3 cap	Hemolynac3 tube assy 		HEMO3 Inlet (D)	
5	Hemolysing reagent HEMOLYNAC•5		Hemolynac5 tube assy 		HEMO5 Inlet (E)	
6	Waste fluid container	Attached to the container	18 L tube assy 8 (WASTE)	Waste tube	WASTE Outlet (F)	

Connecting the Power Cord and Grounding the Hematology Analyzer



Connecting the Power Cord

Connect the provided power cord to the AC SOURCE socket on the rear panel and plug the cord into a 3-prong AC outlet on the wall.

CAUTION

Only use the provided power cord. Using other power cords may result in electrical shock or other injury to the operator.

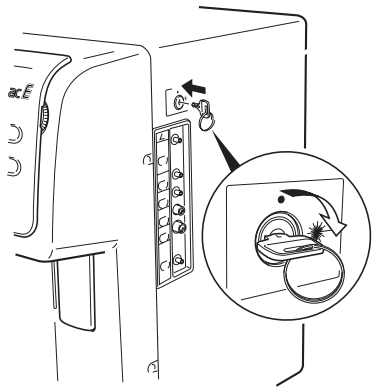
Equipotential Grounding

When equipotential grounding is required, connect the equipotential ground terminal on the rear panel of the hematology analyzer (terminal marked by ⏚) to the equipotential ground terminal on the wall (equipotential grounding system) with the equipotential grounding lead (potential equalization conductor).

WARNING

For operator safety, equipotential grounding of all instruments must be performed. Consult with a qualified biomedical engineer.

Turning the Laser Switch On

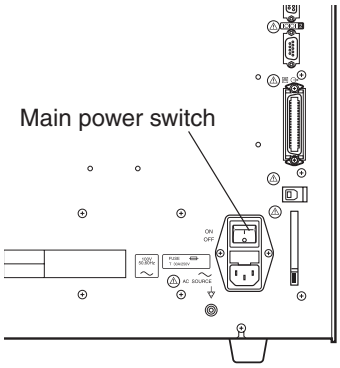


Insert the laser key into the laser switch hole on the right side panel and turn the laser switch to the side marked by ✷ .

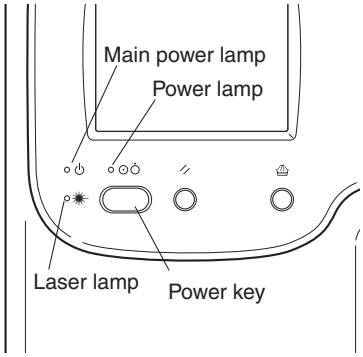
NOTE

- **When the measurement is performed with the laser switch turned off, CBC can be measured but there is no WBC 5 part differential scattergram and data, and an alarm occurs.**
- **Store the key in a safe place.**

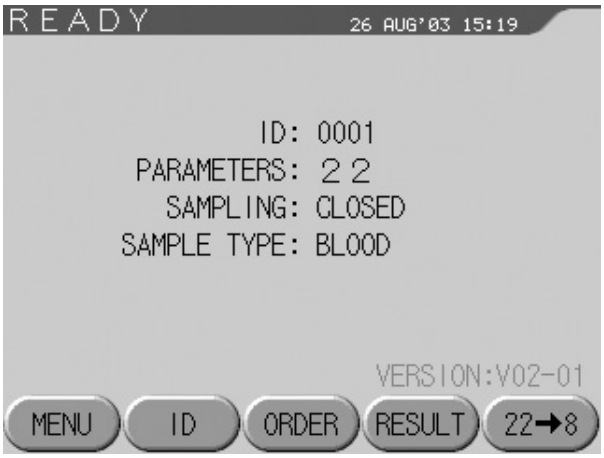
Turning On the Power



1. Press the main power switch on the rear panel of the hematology analyzer to on. The main power lamp on the front panel lights.

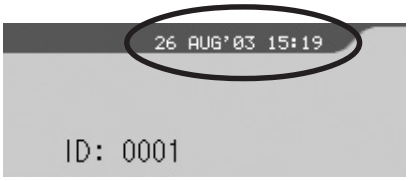


2. Press the power key on the front panel to on. The power lamp lights. When the laser switch on the right side panel is turned on, the laser lamp also lights. Checking the reagents, priming and circuit self-check are automatically performed. After priming operation is completed, the READY screen appears. The hematology analyzer is ready for counting.



Setting the Date & Time and Cleaning the Hematology Analyzer

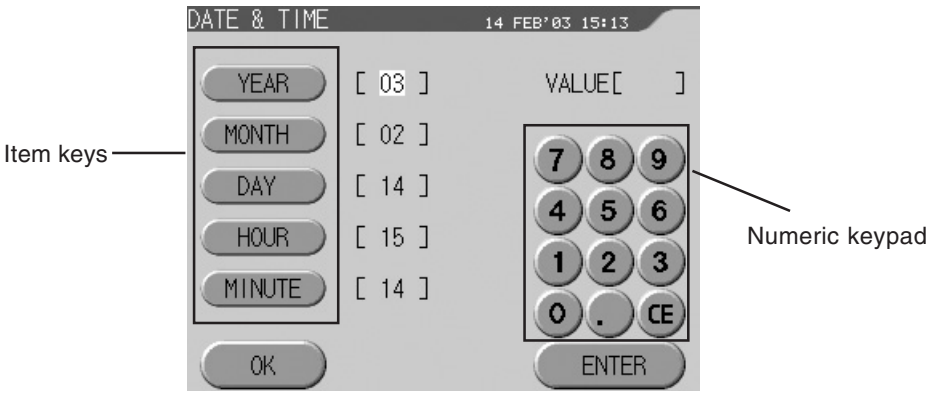
Checking the Date and Time Settings



After turning the hematology analyzer power on, check that the date and time displayed at the upper right of the screen are correct.

1. Display the DATE & TIME screen.
   MENU → SETTINGS → DATE & TIME

2. Select the setting item by pressing the item key. The cursor moves to the item.



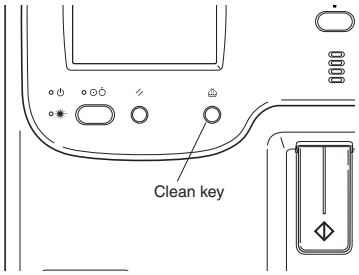
3. Enter the value using the numeric keys. The entered value appears next to VALUE.

4. Press the ENTER key to register the value. The cursor moves to the next item.

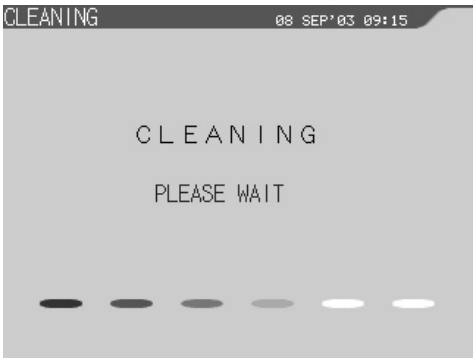
5. Repeat steps 2 to 4 to enter other items.

6. Press the OK key to finish setting and return to the SETTINGS screen. The clock starts immediately from the new date and time.

Cleaning the Fluid Path in the Hematology Analyzer



1. Clean the fluid path in the hematology analyzer by pressing the clean key (🧹) on the front panel.



The READY screen appears after cleaning. It takes about 12 minutes for cleaning.

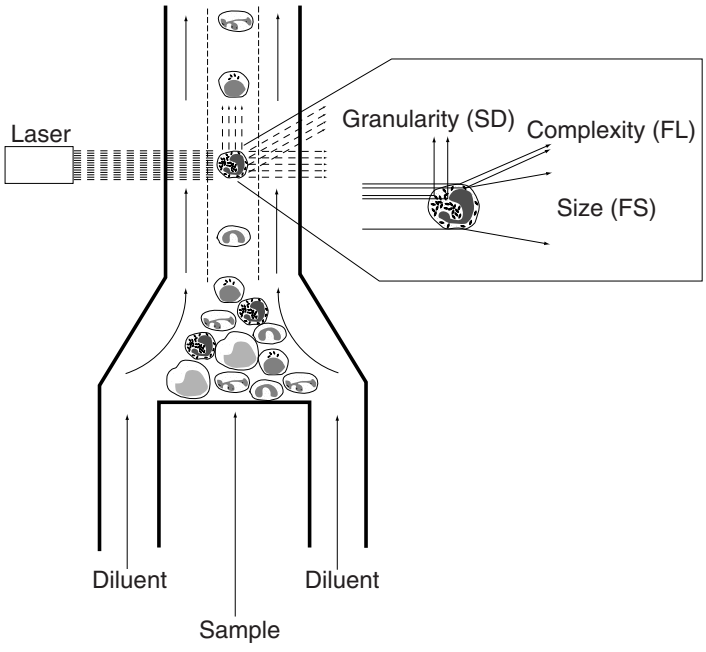
2. Perform cleaning again by pressing the Clean key.
   Clean the fluid path more than 2 times.

Adjusting Gain and Measuring Background Noise

Flowchart

1. Count the polymer microsphere suspensions to check the CV and PEAK values.
2. Adjust the flow cell unit position.
3. Adjust gain for WBC 5 part differential parameters in rough mode using polymer microsphere suspensions.
4. Measure background noise.
5. Adjust gain for WBC 5 part differential parameters in fine mode using venous blood samples from different healthy people which are 30 minutes to 8 hours after collection.
6. Check the actual peak list for all samples. Make sure the average peak of MO is optimum.

Reference: Principle of Differentiating WBC



The hematology analyzer uses the light scatter technique to differentiate WBC into neutrophil, lymphocyte, monocyte, eosinophil and basophil counts.

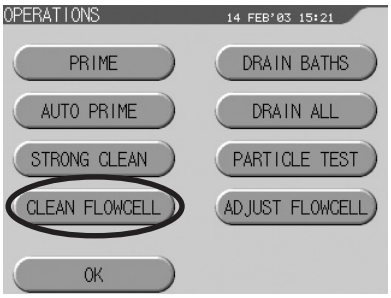
The diluted blood sample is injected into the flow cell. Blood cells pass through the sensing zone one by one. A laser beam through the sensing zone is scattered by the passing cells and the scattered light is detected. The angle and intensity of scattered light indicates the volume and characteristics of the cell. From this, WBC is differentiated into 5 parts.

In gain adjustment, you adjust the following.
- FS (forward small angle scatter)
- FL (forward large angle scatter)
- SD (side scatter)

From the forward small angle scatter, the size of the cell is detected.
From the forward large angle scatter, the complexity of the cell is detected.
From the side scatter, the granularity of the cell is detected.

Counting the Polymer Microsphere Suspensions

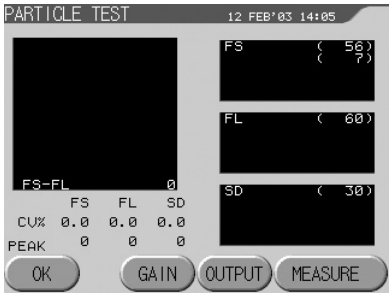
Count the polymer microsphere suspensions (YZ-0194, supply code no. T905) to check the CV and PEAK values.



1. Clean the flow cell to remove dust and bubbles inside the flow cell. Press the CLEAN FLOWCELL key on the OPERATIONS screen to clean the flow cell.

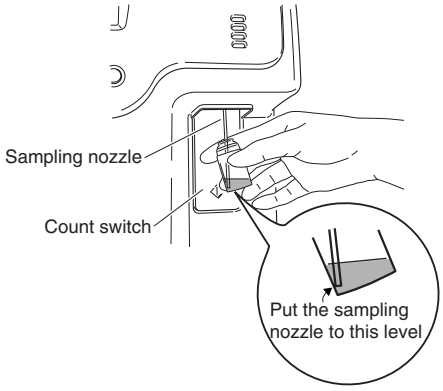
2. Prepare 1 mL of polymer microsphere suspensions in a sample container.

3. When the MS-721V cap pierce unit is installed, select OPEN mode on the ORDER screen.



4. Display the PARTICLE TEST screen.
   MENU → OPERATIONS → PARTICLE TEST

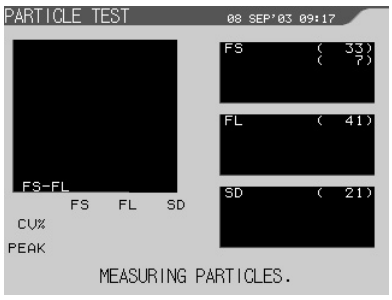
5. Press the MEASURE key. The "PRESS [COUNT] KEY TO START" message appears and the hematology analyzer is ready for counting the polymer microsphere suspensions.



6. Put the sampling nozzle into the bottom of the sample container containing the polymer microsphere suspensions so that the tip of the sampling nozzle comes near the bottom of the sample container.

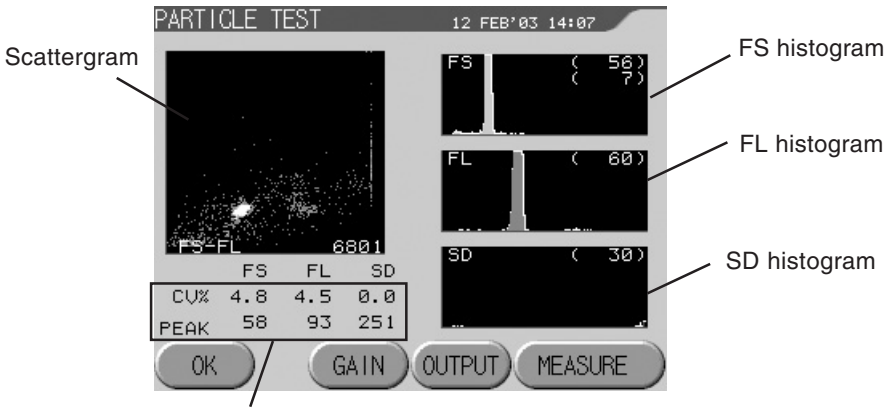
NOTE

Do not let the sampling nozzle touch the bottom of the sample container. This may prevent aspiration of the polymer microsphere suspensions.



7. Press the Count switch. The polymer microsphere suspensions is aspirated and measurement starts. The "MEASURING PARTICLES" message appears on the screen and the scattergrams and histograms appear in real-time.
   The measurement lasts approximately 40 seconds.

8. After finishing the particle test, the CV and PEAK values calculated from the scattergram and histogram appear on the screen.



9. Check that CV and PEAK values are within the following range.

FS	CV:	7.0% or less
	PEAK:	61 ± 3
FL	CV:	7.0% or less
	PEAK:	90 ± 3

NOTE

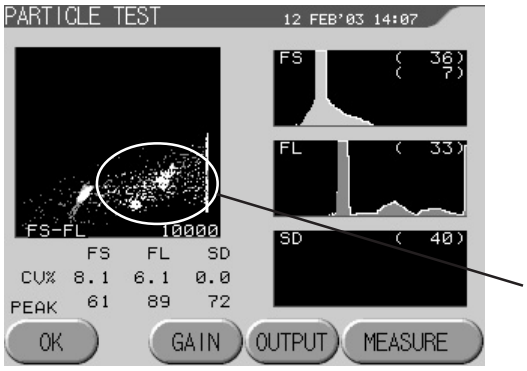
- **There is no need to check CV and PEAK values of SD.**
- **If the CV value of FS or FL is more than 7%, the flow cell position must be adjusted. Refer to the "Adjusting the Flow Cell Unit Position" section.**
- **If the PEAK value of FS or FL is outside the above range, the gain for WBC 5 part differential measurement must be adjusted. Press the GAIN key to go to the SENS&THRESHOLD screen to adjust gain. Refer to the "Adjusting Gain (FS and FL) for WBC 5 Part Differential Parameters in Rough Mode Using Polymer Microsphere Suspensions" section.**

FS (Forward Small): Size (vertical axis of the scattergram)
FL (Forward Large): Complexity (horizontal axis)
SD (Side): Granularity (horizontal axis)
THR: Threshold of FS

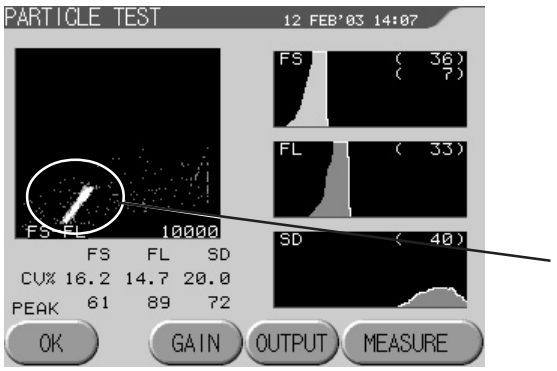
When the CV is Not Optimum

- CV of FS or FL is over 7.0%

  If the polymer microsphere suspension is old, it clots and CV value is not optimum. Replace the polymer microsphere suspensions and perform the particle test again.



- The scattergram is large
  If dust or bubbles accumulate inside the flow cell, the scattergram of polymer microsphere suspensions becomes large. Clean the flow cell by pressing the CLEAN FLOWCELL key on the OPERATIONS screen or clean the fluid path in the hematology analyzer by pressing the Clean key on the front panel. If this does not improve it, adjust the flow cell position.



Adjusting the Flow Cell Unit Position

Check Points before Adjusting the Flow Cell Unit Position

The flow cell unit position is adjusted to the most appropriate position at the factory. When the CV value from the particle test is over the normal range, it is probably caused by dust or bubbles inside the flow cell. Check the following items before adjusting the flow cell unit position.

1. Did you clean the fluid path and flow cell in the hematology analyzer by pressing the Clean key on the front panel or by pressing the CLEAN FLOWCELL key on the OPERATIONS screen?

   You need to completely remove air bubbles from inside the flow cell with the CLEANAC detergent when the hematology analyzer is first installed. Bubbles inside the flow cell cannot be removed by priming at power on or strong cleaning. Bubbles and dust can be removed by cleaning the flow cell by pressing the Clean key on the front panel or pressing the CLEAN FLOWCELL key on the OPERATIONS screen.
   If the CV from the particle test is over the normal range, perform cleaning by pressing the Clean key on the front panel or CLEAN FLOWCELL key on the OPERATIONS screen.

2. CLEANAC and CLEANAC•3 detergents are connected correctly?

   If CLEANAC and CLEANAC•3 detergents are connected incorrectly, bubbles inside the flow cell can not be removed.
   Connect CLEANAC and CLEANAC•3 correctly and clean the hematology analyzer by pressing the Clean key on the front panel or CLEAN FLOWCELL key on the OPERATIONS screen.

3. Out of diluent or detergent alarm are not displayed?

   If diluent or detergent runs out, bubbles enter the flow cell. If the "out of diluent or detergent" alarm appears, replace diluent or detergent and clean the fluid path in the hematology analyzer by pressing the Clean key on the front panel or CLEAN FLOWCELL key on the OPERATIONS screen.

4. The polymer microsphere suspensions are old or coagulated.

   Perform the particle test after getting new polymer microsphere suspensions and adjust the flow cell unit position only when the CV value of the particle test greatly exceeds 7%.

Adjusting the Flow Cell Unit Position

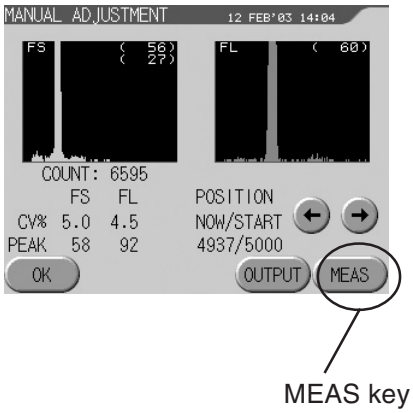
The flow cell unit must be adjusted when the laser does not scatter exactly on the sample flowing inside the flow cell. Check if the laser scatters on the sample by the particle test.

NOTE

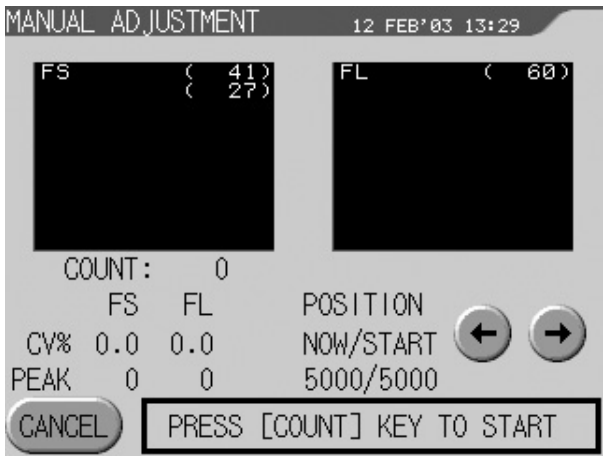
- **When the flow cell is clogged with dust, it cannot be adjusted correctly.**
- **Clean the fluid path in the hematology analyzer by pressing the Clean key on the front panel or CLEAN FLOWCELL key on the OPERATIONS screen before adjusting the flow cell unit position.**

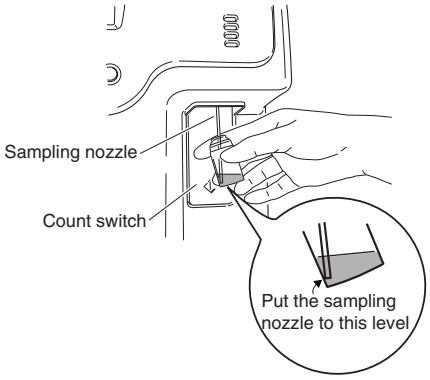
1. Prepare 1 mL of polymer microsphere suspensions in a sample container.

2. Display the MANUAL ADJUSTMENT screen.
   MENU → OPERATIONS → ADJUST FLOWCELL → MANUAL ADJUST



3. Press the MEAS key. The "PRESS [COUNT] KEY TO START" message appears and the hematology analyzer is ready to count the polymer microsphere suspensions. Use the CANCEL key to return to the OPERATIONS screen.



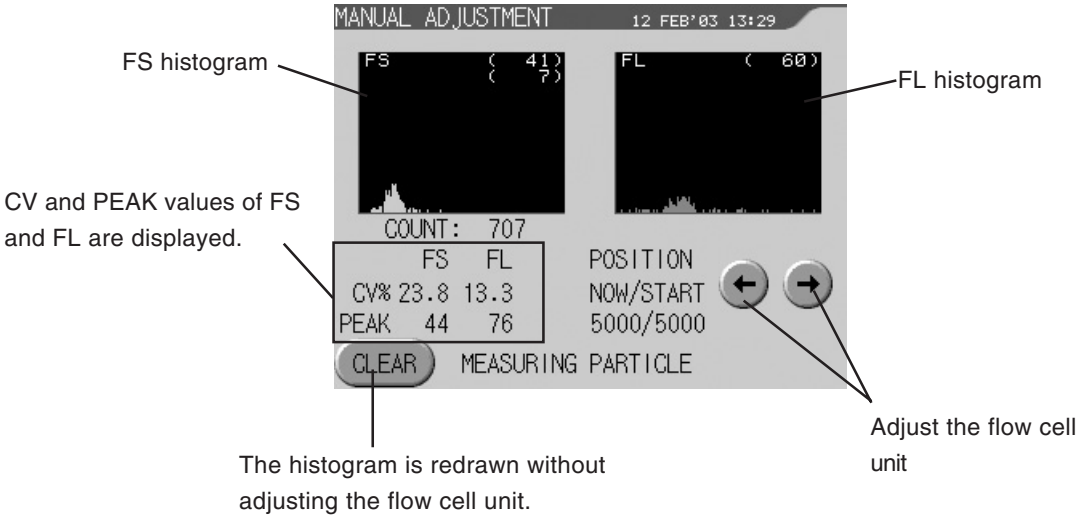


4. Put the sampling nozzle into the bottom of the sample container containing the polymer microsphere suspensions so that the tip of the sampling nozzle comes near but does not touch the bottom of the sample container.

NOTE

Do not let the sampling nozzle touch the bottom of the sample container. This may prevent aspiration of the polymer microsphere suspensions.

5. Press the Count switch. The polymer microsphere suspensions in the sample container are aspirated and measurement starts. The "MEASURING PARTICLE" message appears on the screen and the scattergrams and histograms appear in real-time.
   The measurement takes approximately 40 seconds.



6. Press the → or ← key to adjust the flow cell unit position. The histogram is automatically redrawn. Adjust the flow cell unit until the CV of FS and FL is minimum and the peak is maximum.

NOTE

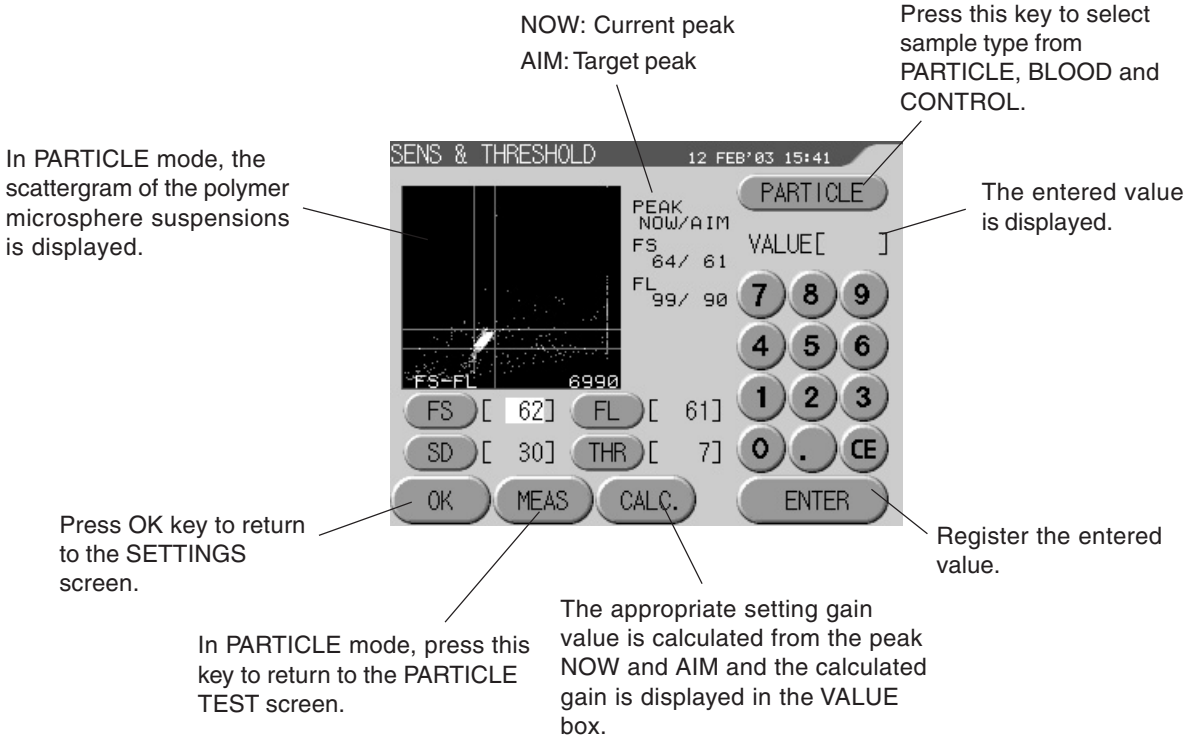
- **Check the CV and PEAK values by measuring the polymer microsphere suspensions again after adjusting the flow cell unit.**
- **If the CV values obtained from measuring new polymer microsphere suspensions which are not coagulated are not optimum after adjusting the flow cell unit, the hematology analyzer may be damaged. Contact your Nihon Kohden distributor.**

Adjusting Gain (FS and FL) for WBC 5 Part Differential Parameters in Rough Mode Using Polymer Microsphere Suspensions

NOTE

Adjust the FS and FL gain only when the PEAK values are not optimum in the particle test.

1. Display the SENS & THRESHOLD screen for WBC 5 part differential parameters by doing one of the following:
   a) Press the GAIN key on the PARTICLE TEST screen.
   b) Press the SENS & THRESHOLD key on the SETTINGS screen and press the DIFF key.


NOW: Current peak
AIM: Target peak
Press this key to select sample type from PARTICLE, BLOOD and CONTROL.
In PARTICLE mode, the scattergram of the polymer microsphere suspensions is displayed.
SENS & THRESHOLD
12 FEB'03 15:41
PARTICLE
PEAK
NOW/AIM
FS
64/ 61
FL
99/ 90
VALUE[ ]
The entered value is displayed.
7 8 9
4 5 6
1 2 3
0 . CE
FS [62] FL [61]
SD [30] THR [7]
OK
MEAS
CALC.
ENTER
Press OK key to return to the SETTINGS screen.
Register the entered value.
In PARTICLE mode, press this key to return to the PARTICLE TEST screen.
The appropriate setting gain value is calculated from the peak NOW and AIM and the calculated gain is displayed in the VALUE box.

The 3 types of histogram (Particle, Blood and Control) and its PEAK value can be displayed with the sample type key on the SENS & THRESHOLD screen for Diff.

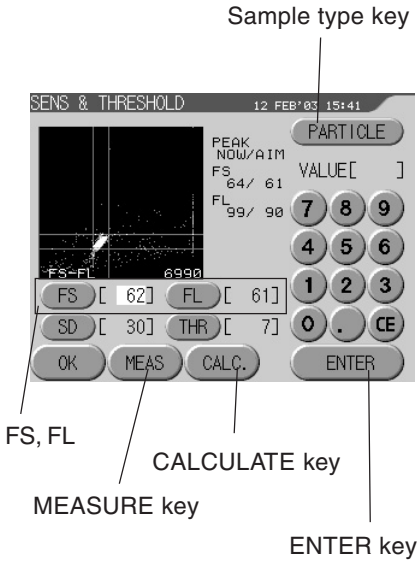
NOW PEAK is the current peak of the displaying scattergram and AIM is the target peak. If the gain is adjusted to the most appropriate value, the values of NOW and AIM match. If the difference between the NOW value and AIM value is more than 5%, the gain must be adjusted.

NOTE

Check that the CV of FS and FL are optimum (less than 7.0%) by counting the polymer microsphere suspensions before adjusting gain. If the CV is not optimum, count the polymer microsphere suspensions again after cleaning the fluid path in the hematology analyzer by pressing the Clean key on the front panel or CLEAN FLOWCELL key on the OPERATIONS screen and check that the CV values are optimum. Adjust the gain only when the CV is optimum.

If the CV of the polymer microsphere suspensions is still not optimum after cleaning and adjusting the flow cell position, contact your Nihon Kohden distributor.

Refer to the “Cleaning the Fluid Path in the Hematology Analyzer”, “Adjusting the Flow Cell Unit Position” and “Counting the Polymer Microsphere Suspensions” sections.



2. Press the sample type key to select PARTICLE to display the scattergram and the peak for the polymer microsphere suspensions.

3. Press the CALC key. The appropriate setting value of FS calculated from the NOW peak and AIM peak appears in the VALUE box.

4. Press the ENTER key. The value displayed in VALUE is entered in FS and the cursor moves to FL.

5. Press the CALC key. The appropriate setting value of FL appears in the VALUE box.

6. Press the ENTER key to register the value for FL.

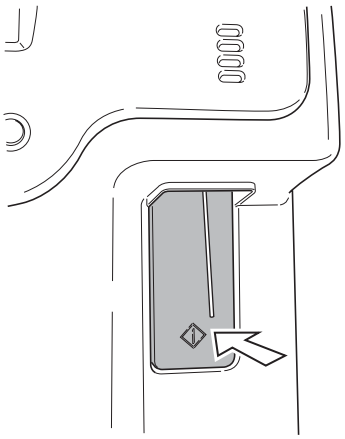
NOTE

In PARTICLE mode, SD gain cannot be adjusted. SD gain is adjusted in fine mode by using human blood samples.

7. Press the MEAS key to return to the PARTICLE TEST screen to count the polymer microsphere suspensions to check the CV and peak value with the adjusted gain.

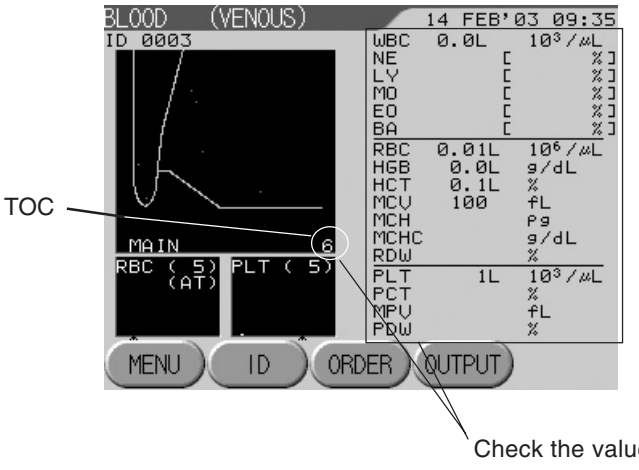
8. Repeat the procedure in the "Counting Polymer Microsphere Suspensions" to this section ("Adjusting the Gain (FS and FL) for WBC 5 Part Differential Parameters in Rough Mode Using Polymer Microsphere Suspensions") until you obtain the optimum peak value.

Measuring Background Noise



1. Display the READY screen and press the Count switch to count the diluent. (There is no need to set the sample.)

   The result appears after measurement is complete.



2. Check the measured values on the result screen. Make sure that the values are less than or equal to the following values.

   WBC: 0.2 ($\times 10^3/\mu L$)
   RBC: 0.05 ($\times 10^6/\mu L$)
   HGB: 0.1 (g/dL)
   PLT: 10 ($\times 10^3/\mu L$)
   TOC: 100 (count)
   (TOC: total optical count. This parameter only appears in a background noise measurement.)

   Disregard the other parameter values because noise does not affect the other parameters.

   If the values are greater than the above values, check the following items, press the Clean key to clean the fluid path and recount the diluent.
   - The diluent is clean.
   - No bubbles in the diluent.
   - The apertures and aperture tubes are clean.
   - The aperture is firmly attached.
   - The measurement baths and sample cup are clean.

Adjusting Gain for WBC 5 Part Differential Parameters in Fine Mode Using Venous Blood Samples

Adjust the gain for WBC 5 part differential parameters in fine mode using for several to 15 venous blood samples from different healthy people which are 30 minutes to 8 hours after collection.

WARNING

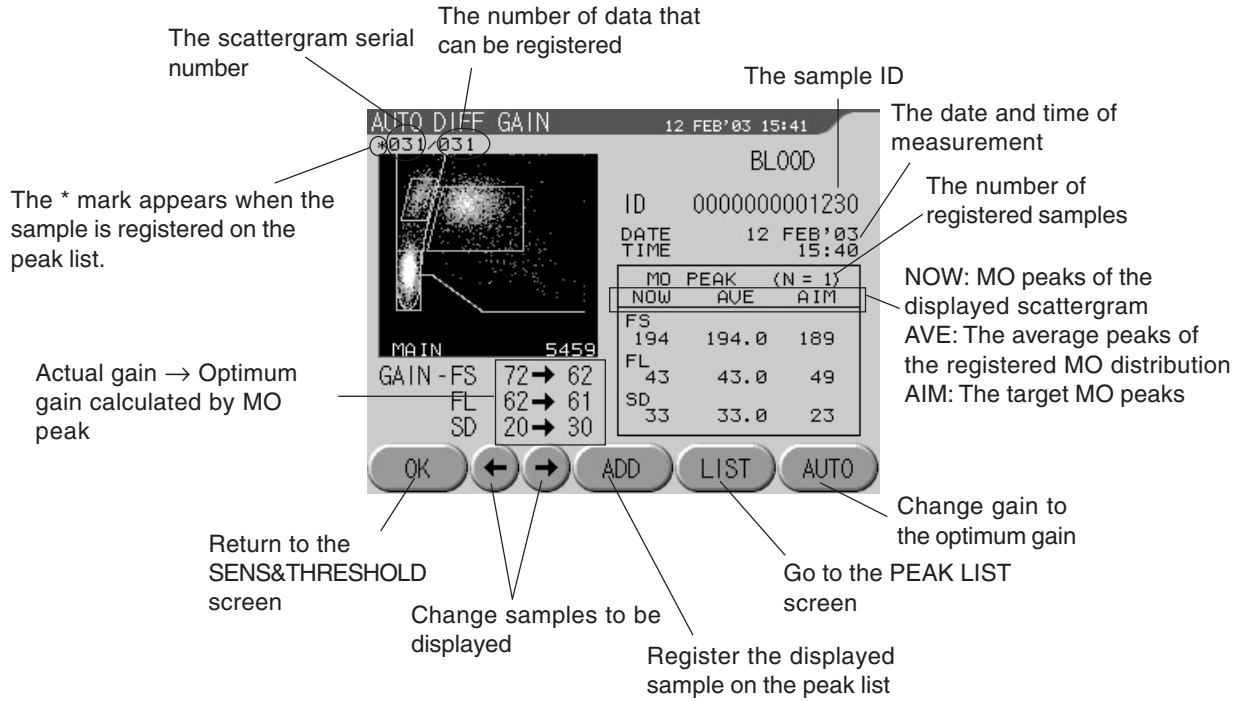
Always wear rubber gloves to protect yourself from infection when handling and measuring blood samples.

Notes about Blood Samples

- **The anticoagulant may cause the blood samples to be unstable for measurement when measured within 30 minutes after collection. For gain adjustment, leave the samples for more than 30 minutes before measurement.**
- **When a sample is stored in a cool place, such as a refrigerator, or when the sample is left for more than 12 hours after collection, it may affect WBC differential measurement.**
- **Thoroughly mix the samples immediately before measurement.**
- **If the blood sample is stirred too much so that bubbles are created, the sample may be hemolyzed.**
- **Do not measure coagulated samples. Counting a coagulated sample may damage the hematology analyzer.**

1. Count from several to about 15 human blood samples from different healthy people which are 30 minutes to 8 hours after collection.

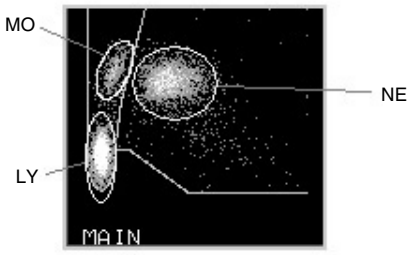
2. Display the AUTO DIFF GAIN screen.
   MENU → SETTINGS → SENS & THRESHOLD → AUTO DIFF GAIN


The scattergram serial number
The number of data that can be registered
The sample ID
The date and time of measurement
The number of registered samples
The * mark appears when the sample is registered on the peak list.
NOW: MO peaks of the displayed scattergram
AVE: The average peaks of the registered MO distribution
AIM: The target MO peaks
Actual gain → Optimum gain calculated by MO peak
Change gain to the optimum gain
Return to the SENS&THRESHOLD screen
Go to the PEAK LIST screen
Change samples to be displayed
Register the displayed sample on the peak list
AUTO DIFF GAIN
12 FEB'03 15:41
*031/031
BLOOD
ID 0000000001230
DATE 12 FEB'03
TIME 15:40
MO PEAK (N = 1)
NOW AVE AIM
FS 194 194.0 189
FL 43 43.0 49
SD 33 33.0 23
MAIN 5459
GAIN-FS 72→62
FL 62→61
SD 20→30
OK
ADD
LIST
AUTO

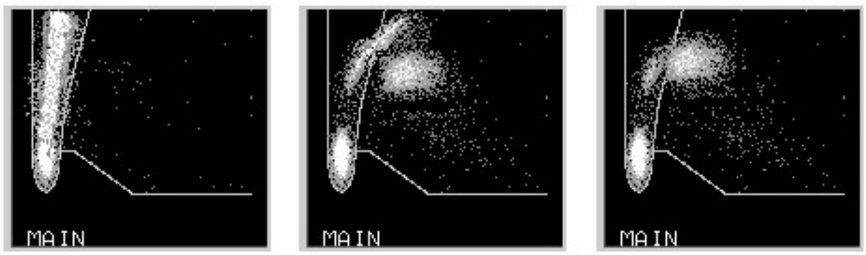
3. Check if the sample is appropriate to use in gain adjustment. Only register appropriate samples for gain adjustment.

   Check Points of the optimum sample for adjustment
   - The distributions of NE, LY and MO are oval in shape on the scattergram.
   - The distributions of NE, LY and MO are separate from each other.
   - NE, LY and MO should be located in the allotted positions.

Optimum scattergram for gain adjustment



Scattergrams which cannot be used for automatic gain adjustment (FS GAIN too high)

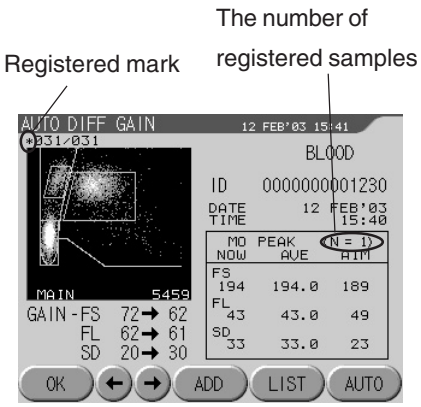


(a) (b) (c)

(a) There is no NE distribution, and MO and LY are not separated on the scattergram. (Scattergram of a leukemia patient)

(b) MO is distributed on NE. (Scattergram of a patient with immature granulocytes)

(c) NE is distributed too close to MO. (Scattergram of a blood sample collected more than 8 hours ago)



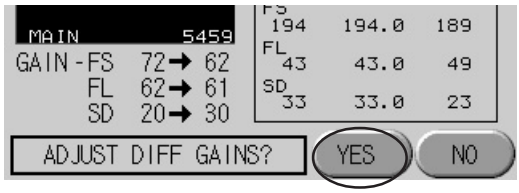
4. Press the ADD key to register the blood sample to the peak list. "*" is displayed in the scattergram serial No. after registration, and the number of N in the MO PEAK table is incremented. Up to 12 samples can be registered. You should have at least 5 samples registered. Press the → and ← keys to change displayed samples.

NOTE

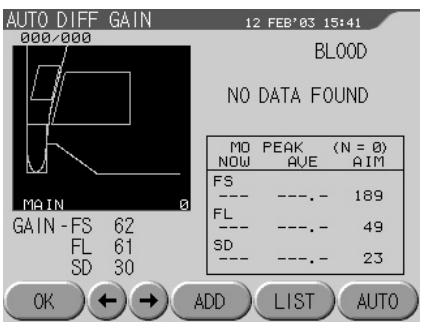
The mean value (AVE) of the registered MO distribution peak data is updated after the sample is registered on the peak list. The gain adjustment is performed using this mean value.

You can check if the obtained result is optimum on the PEAK LIST screen before adjusting gain. For details on the PEAK LIST, refer to the operator's manual.

5. Press the AUTO key after finishing registration. The "ADJUST DIFF GAINS?" message appears.



6. Press the "YES" key to change diff gains. The peak list of the registered blood samples is initialized.



Checking the Gain Adjustment

1. Count from several to about 15 human blood samples from different healthy people which are 30 minutes to 8 hours after collection.

2. Display the AUTO DIFF GAIN screen.
   MENU → SETTINGS → SENS & THRESHOLD → AUTO DIFF GAIN

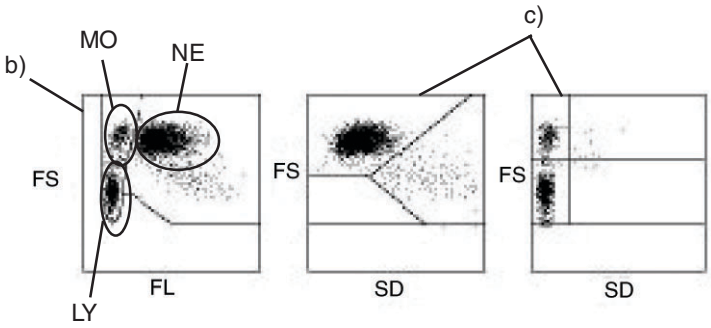
3. Register the measured samples.

4. Check that the scattergram and MO are optimum.

5. Check the scattergram in each measured data. Press the scattergram display area to change the scattergram between MAIN, NE/EO and MO/BA.

   Scattergram check points

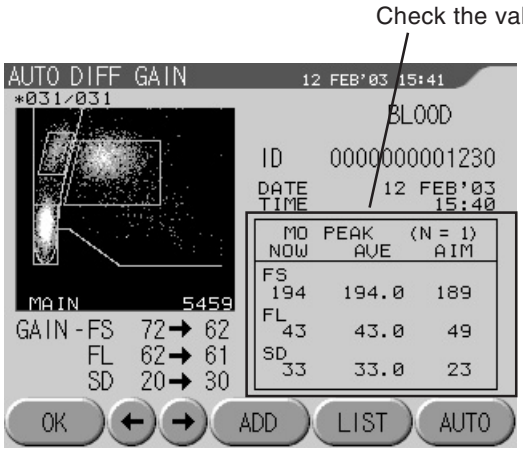
   a) The scattergrams are oval in shape and not touching the division line.
   b) The scattergrams are in the MO, LY and NE area on the left scattergram.
   c) There are not many scattergrams in the upper right and central area.



   MO PEAK check point

   AVERAGE PEAK and IDEAL PEAK are the same.

FS AVE = 186 to 192
FL AVE = 47 to 51
SD AVE = 21 to 23



6. If the measured data is not optimum, perform the procedure in the "Adjusting Gain for WBC 5 Part Differential Parameters in Fine Mode Using Venous Blood Samples" section again.

NOTE

The measured data is not optimum if the human blood sample used in the above measurement is abnormal or the gain was adjusted greatly in the adjustment in fine mode.

Calibration

Procedure Flowchart

1. Perform calibration measurement with MEK-3DN calibrator to obtain a mean value for calculating the new calibration coefficient.

2. Perform the calibration for CBC parameters (WBC, RBC, HGB, MCV, PLT, RDW, MPV) using the MEK-3DN calibrator.

3. Check that the calibration coefficients for WBC 5 part differential parameters (LY%, MO%, EO%, BA%) are 1,000 on the CALIBRATION screen. In the gain adjustment performed in the previous section, WBC 5 part differential parameters are already accurately calibrated. Therefore, you only need to check the calibration coefficient.

Calibration for CBC Parameters with Calibrator

Calibration can be performed for the following parameters in venous blood mode and capillary blood mode individually.

- WBC
- MCV
- RDW
- RBC
- PLT
- MPV
- HGB

The MEK-3DN hematology control can be used as a calibrator if it is stored at 2 to 8°C and is used within 3 days after opening. For higher accuracy, use the calibrator soon after opening.

HCT is calibrated from RBC and MCV. Therefore, it is calibrated by calibrating RBC and MCV.

NOTE

- **Calibration with calibrator can be performed for WBC, RBC, HGB, HCT, PLT and MPV, but not for WBC differential parameters. To calibrate WBC differential parameters, refer to the "Calibration for WBC 5 Part Differential Parameters" section.**
- **The MEK-5DN hematology control cannot be used as a calibrator. MEK-5DN is for accuracy control.**
- **MEK-3DN is for accuracy control of the hematology analyzer refined from normal human blood. The calibrator contains living cells. Handle and store the calibrator properly following the instructions in the assay sheet.**

Measuring the MEK-3DN Hematology Control

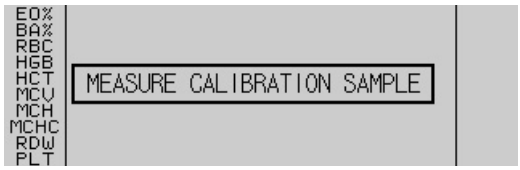
To perform accurate calibration, you need to obtain a mean value of the calibration measurement by measuring the MEK-3DN more than 3 times. The mean value of the measured data can be automatically calculated and entered on the CALIBRATION screen.

NOTE

- **Check that the measurement mode is correct (venous blood mode or capillary blood mode).**
- **Calibration in venous mode must be checked before calibration in capillary mode.**
- **Perform the measurement for capillary blood calibration in the capillary blood mode by pressing the Capillary mode key on the front panel. Prepare the capillary blood samples of the volume you have selected on the CAPILLARY screen on the MEASURE MODE screen. For details, refer to the operator's manual.**

1. Display the CALIBRATION MEASURE screen.
   MENU → CALIBRATION → CAL MEASURE

   If there is no calibrator measured data stored in the memory, the "MEASURE CALIBRATION SAMPLE" message appears.

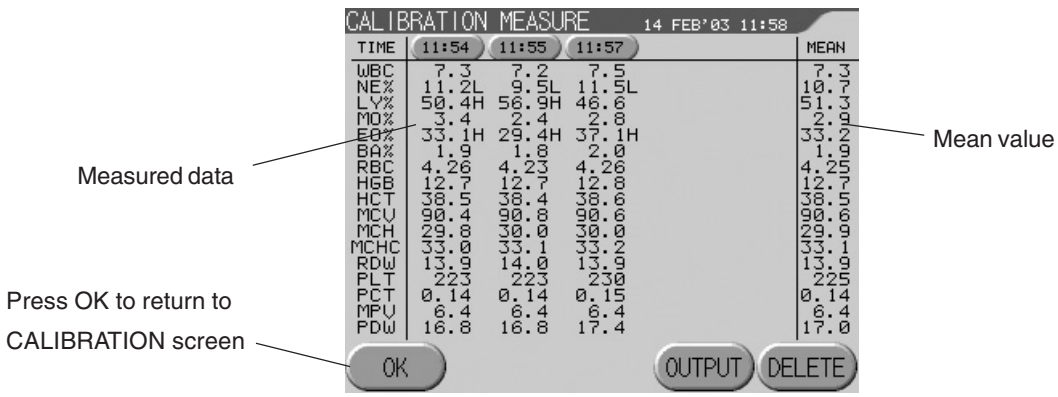


2. Measure the calibrator. The "MEASURING" message appears on the screen.

   After measurement, the measured data appears on the screen.

3. Measure the calibrator more than 3 times. The screen lists the measured data for each measurement and the mean value of all measurements.

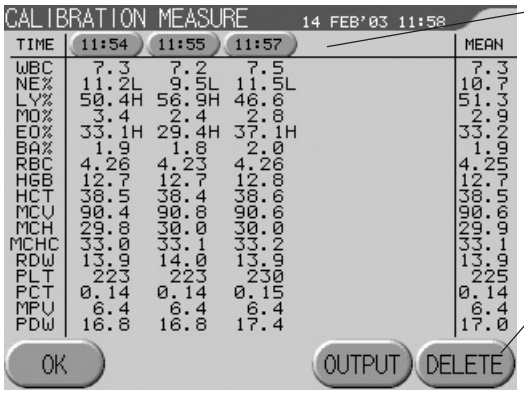
   Up to 5 measurement data can be listed. If you measure more than 5 times, the oldest data is deleted to store the latest data.



4. Check that there is no considerable difference in the listed data and press the OK key to return to the CALIBRATION screen. If one data is extremely different from the others, delete the data and measure the calibrator again to obtain the data close to other measured data.

   To delete data:

   a) Press the DELETE key. The "SELECT DATA TO DELETE" message appears.



   b) Press the time key of the desired data. The "DELETE DATA?" message appears.

   c) Press the YES key to delete the data. The screen automatically returns to the CALIBRATION MEASURE screen after deleting the data.
   If you press NO, the process is canceled and the screen returns to the CALIBRATION MEASURE screen.

5. Press the OK key to return to the CALIBRATION screen.

NOTE

If you return to the MENU screen or go to another screen except for the CALIBRATION screen from the CALIBRATION MEASURE screen, all measured data are automatically deleted. After calibration, all measured data are automatically deleted.

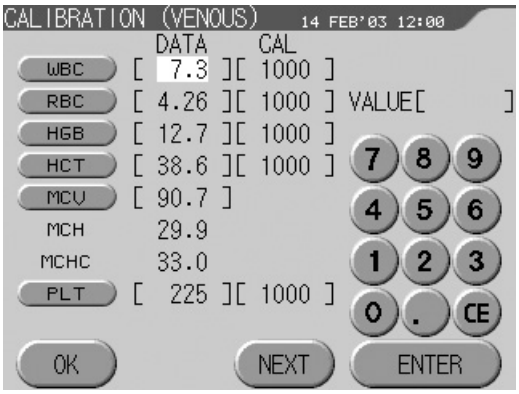
You can perform calibration by entering either the calibration coefficient or the new measured value.

Calibration by Calibration Coefficient

1. Press the VENOUS key on the CALIBRATION screen to display the CALIBRATION (VENOUS) screen.

NOTE

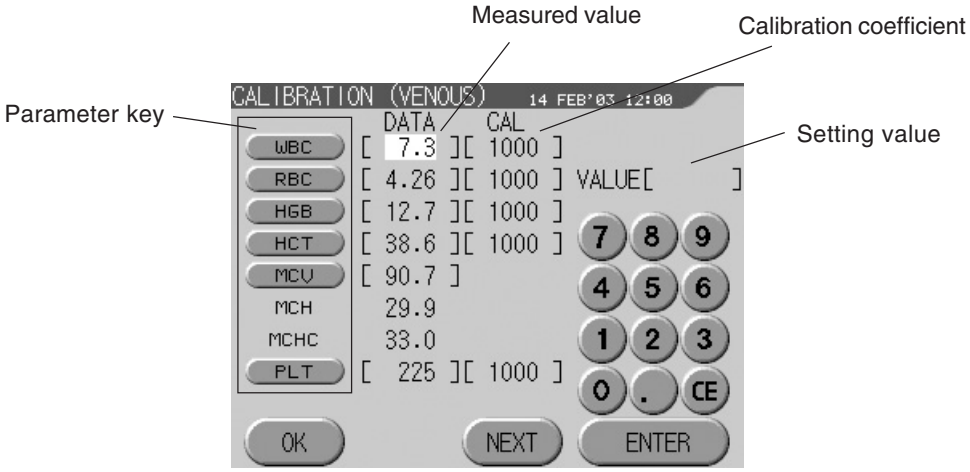
Write down the current settings before changing them.



2. Calculate the new calibration coefficient based on the following formula. The calibration coefficient is on the assay sheet provided with the hematology control and the mean measure value which were obtained in the "Measuring the MEK-3DN Hematology Control" procedure appears in the DATA column.

$$\text{New calibration coefficient} = \text{Previous calibration coefficient} \times \frac{\text{Calibrator assay value}}{\text{Mean measured value}}$$

3. Select the desired parameter by pressing the parameter key. As you press the key, the cursor moves between the DATA and CAL fields.



4. Move the cursor to the CAL field and enter the new calibration coefficient obtained in step 2 using the numeric keypad. The entered value appears in the VALUE box.

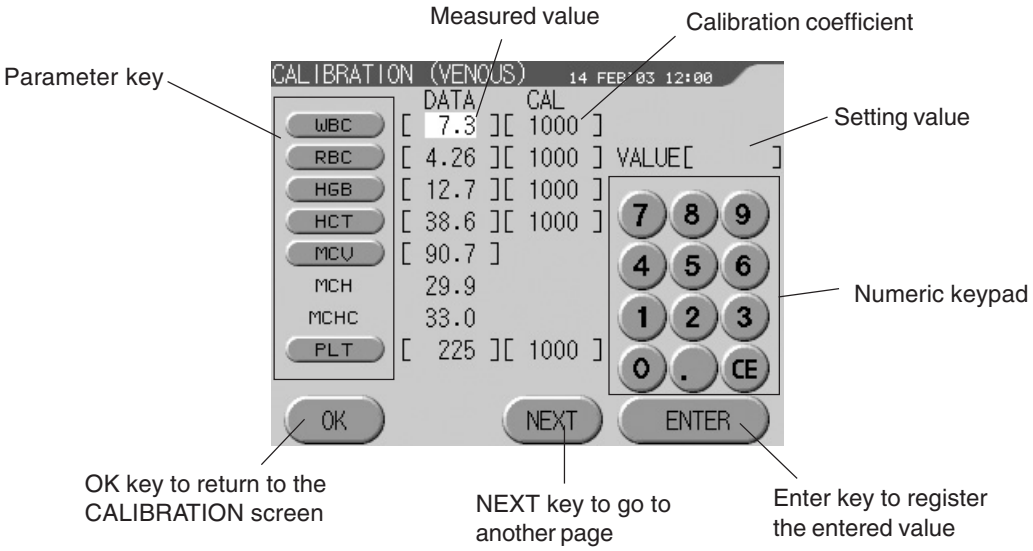
5. Press the ENTER key to register the value. When you register a new calibration coefficient, the measured data also changes. Change all necessary values.

6. Press the OK key to return to the CALIBRATION screen.

Calibration by Measured Data

1. Press the VENOUS key on the CALIBRATION screen to display the CALIBRATION (VENOUS) screen.

2. Select the desired parameter by pressing the parameter key. As you press the key, the cursor moves between the DATA and CAL fields.



3. Move the cursor to the DATA field and enter the median of the assay value listed in the assay sheet using the numeric keypad. The entered value appears in the VALUE box.

4. Press the ENTER key to register the value. When you register new measured data, the calibration coefficient also changes. Change all necessary values.

5. Press the OK key to return to the CALIBRATION screen.

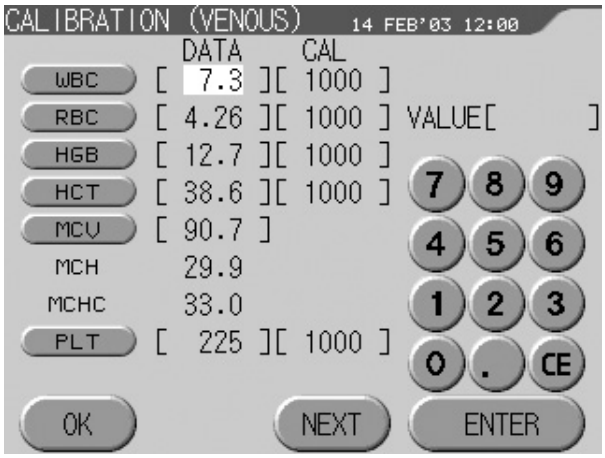
NOTE

After calibration, all measured data are automatically deleted.

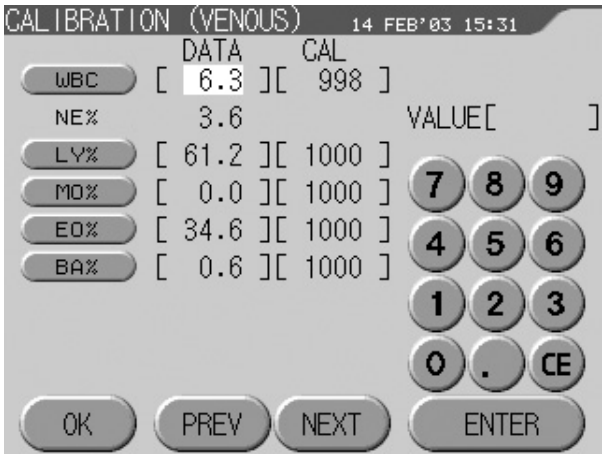
Calibration for WBC 5 Part Differential Parameters

Check that the calibration coefficients of LY%, MO%, EO% and BA% for WBC 5 part differential parameters are 1000. In the gain adjustment performed in the previous sections, WBC 5 part differential parameters are already accurately calibrated. Therefore, you only need to check the calibration coefficient.

1. Display the CALIBRATION (VENOUS) screen.
   MENU → CALIBRATION → VENOUS



2. Press the NEXT key to display the WBC 5 part differential parameters.



3. Check that the calibration coefficients of LY%, MO%, EO% and BA% are 1000.

   If the calibration coefficients are not 1000, move the cursor to that CAL field and enter "1000" using the numeric keypad. Press the ENTER key to register 1000 as the calibration coefficient.

Checking the Data

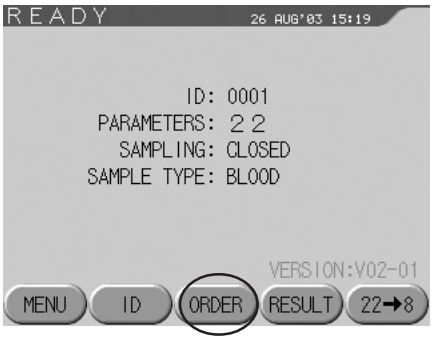
Check the following data to confirm that the gain is adjusted and calibration is performed properly.

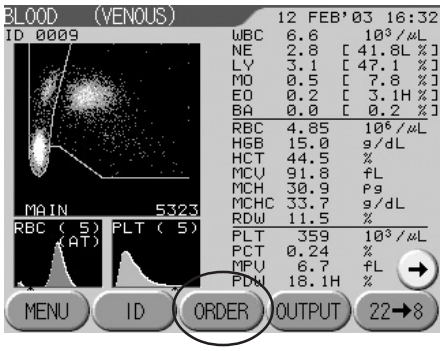
a) Measure the MEK-5DN/L/H hematology control to check that the obtained data falls within the acceptable range on the assay sheet attached to the hematology control.

b) Count more than 10 venous blood samples from different healthy people which are 30 minutes to 8 hours after collection and make sure that there is no flag such as “Left Shift”, “Blasts”, “Immature Granulocyte”, or “Atypical Lymphocytes” displayed.

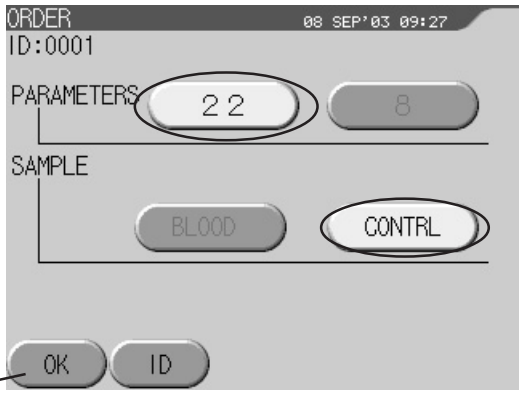
Checking Data with MEK-5D Hematology Control

1. Press the ORDER key on the READY screen or the measured data display screen to display the ORDER screen.





2. Select CONTROL as the sample and select 22 as the parameters.



Press OK key to return to READY screen.

3. Press the OK key to return to the READY screen.

4. Measure the MEK-5D hematology control. The result appears on the screen.

5. Check that the obtained data falls within the acceptable range on the assay sheet attached to the hematology control.

Checking Data with Human Blood Samples

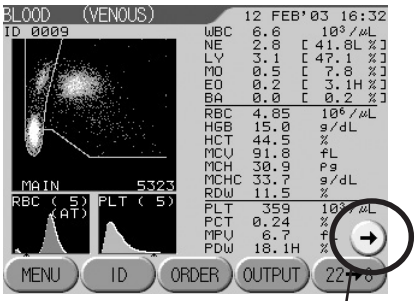
Count more than 10 venous blood samples from different healthy people which are 30 minutes to 8 hours after collection and make sure that there is no flag such as “Left Shift”, “Blasts”, “Immature Granulocyte”, “Atypical Lymphocytes” or “Eosinophilia” displayed.

WARNING

Always wear rubber gloves to protect yourself from infection when handling and measuring blood samples.

1. Count more than 10 human blood samples from different healthy people which are 30 minutes to 8 hours after collection.

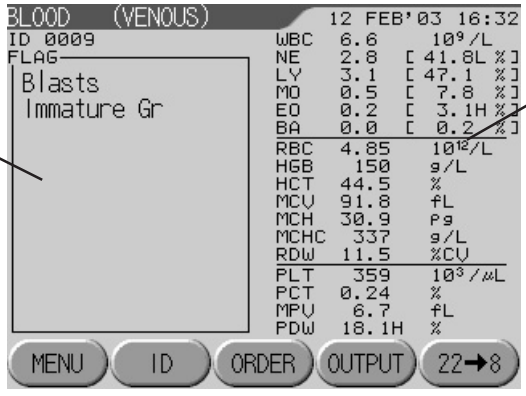
2. Check that none of the following flags is displayed. Press the flag key to check this.
   - Immature Granulocyte
   - Blasts
   - Left Shift
   - Atypical Lymphocyte
   - Eosinophilia



Flag key

Flag Display Screen

The Flag key appears and flashes on the screen if there is flag. Press the flag key to display the flag display screen. There is no flag if the flag key is not displayed.



Press the flag display area to return to the previous screen.

Measured data
Press here to display the magnification of the data.

If there is a flag, repeat the procedure in the “Adjusting Gain for WBC 5 Part Differential Parameters in Fine Mode Using Venous Blood Samples” section. Perform the calibration again if the data obtained in the above measurement differs from the data obtained using other instruments or at other test facilities. Calculate the new calibration coefficient for each parameter from the mean value of measured data obtained by the MEK-7222J/K hematology analyzer and other means.

Interference Substances

WBC: **Unlysed red cells**

In some rare occasions, the RBC in the blood sample may not completely lyse and these non-lysed RBC may be detected as WBC and cause increase in WBC count.

Multiple myeloma

The precipitation of proteins in multiple myeloma patients may increase the WBC count.

Leukemia

WBC is fragile in leukemia patients and WBC may be destroyed during measurement. These WBC fragments may also interfere with WBC differential measurement.

Chemotherapy

Cytotoxic and immunosuppressive drugs cause low WBC count.

Cryoglobulins

Cryoglobulin may be increased in patients who are pregnant or have myeloma, cancer, leukemia, macroglobulinemia, lymphoproliferative disorders, metastatic tumors, autoimmune disorders, infections, aneurysm, thromboembolic phenomena, diabetes, etc, which cause increase in WBC, RBC or PLT counts and HGB concentration. In such cases, warm the blood sample to 37°C in a water bath for 30 minutes and measure the sample immediately.

RBC: **Leukemia**

An increase in WBC in leukemia patient causes increase in RBC.

Agglutinated RBC

Agglutinated RBC may decrease RBC count. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Cold agglutinins

IgM immunoglobulins which are elevated in clod agglutinin disease may decrease RBC and PLT counts and increase MCV.

HGB: **Turbidity of the blood sample**

Any physiologic and/or therapeutic factors may increase HGB. In such a case, determine the cause of turbidity and follow the appropriate method below.

1. Increased WBC
   An extreme increase in WBC causes excessive light scatter. In these cases, measure manually. Centrifuge the diluted sample and measure the supernatant fluid with a spectrophotometer.
2. Increased lipids
   The blood sample may be milky when there is excessive lipids. This may occur with hyperlipidemia, hyperproteinemia and hyperbilirubinemia. Accurate HGB measurement can be achieved by manual methods and a plasma blank.
3. Increased turbidity
   When RBC are resistant to lysing, turbidity may increase causing increase in HGB. Observe if MCH and MCHC values are abnormal. HGB result affects MCH and MCHC result.
4. Fetal bloods
   The mixing of fetal and maternal blood may increase HGB value.
5. High WBC levels
   Turbidity of blood increases and the hemoglobin concentration becomes high if WBC level of the blood sample is high. MCH and MCHC levels also become high.

HCT: **Agglutinated RBC**

RBC agglutination may cause erroneous HCT and MCV values. Observe if MCH and MCHC values are abnormal. In such a case, measure manually.

MCV: **Agglutinated RBC**

RBC agglutination may cause erroneous HCT and MCV values. Observe if MCH and MCHC values are abnormal. In such a case, measure manually.

Excessive number of large PLT

Excessive number of large PLT and/or excessively high WBC may affect the MCV value. Check by careful examination of the stained blood film.

MCH: MCH is determined from HGB and RBC values. Therefore, the limitations for HGB and RBC also affect MCH value.

MCHC: MCHC is determined from HGB and HCT values. Therefore, the limitations for HGB and HCT also affect MCHC value.

RDW: RDW is determined from RBC value. Therefore, the limitations for RBC also affect RDW value.

Agglutinated RBC

Agglutinated RBC may decrease RBC count and erroneous RDW. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Nutritional deficiency or blood transfusion

Iron and/or cobalamin and/or folate deficiency may increase RDW.

PLT: **Very small fragments**

Very small RBC, RBC fragments and WBC fragments may be the cause in increased PLT count.

Agglutinated RBC

PLT may be trapped in the agglutinated RBC resulting in decrease in PLT. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Very large PLT

Large PLT may exceed the PLT threshold and might not be counted which results in low PLT count.

Chemotherapy

Cytotoxic and immunosuppressive drugs may increase the fragility of cells which may cause low PLT count. In such a case, measure manually.

Hemolysis

Hemolyzed specimens contain red cell stroma which may increase PLT count.

Anticoagulated blood

Blood anticoagulated with acid-citrate-dextrose may have clumped PLT which may cause decrease in PLT count.

Agglutinated PLT

Clumped PLT may decrease PLT count and/or increase WBC count. For such sample, collect the sample in sodium citrate anticoagulant and measure only PLT. The PLT result must be corrected for the sodium citrate dilution effect.

MPV: **Very large PLT**

Large PLT may exceed the PLT threshold and not be counted which results in low MPV.

Very small fragments

Very small RBC, RBC fragments and WBC fragments may interfere with MPV measurement.

Agglutinated RBC

PLT may be trapped in the agglutinated RBC resulting in erroneous MPV. This can be checked by abnormal MCH and MCHC values and examination of the stained blood film.

Chemotherapy

Cytotoxic and immunosuppressive drugs may affect MPV. In such a case, measure manually.

NOTE

Blood samples collected in EDTA do not maintain stable MPV because platelets swell depending on the interval after collection and storage temperature.

WBC 5 part differential parameters are derived from the WBC count, therefore, the limitations for WBC also affect these parameters.

NE and NE%: Excessive eosinophils, metamyelocytes, myelocytes, promyelocytes, blasts and plasma cells may interfere with an accurate NE count and NE%.

LY and LY%: Erythroblasts, certain parasites and RBC that are resistant to lysis may interfere with an accurate LY count.

MO and MO%: Large lymphocytes, atypical lymphocytes, blasts and excessive number of basophils may interfere with an accurate MO count.

EO and EO%: Abnormal granules may interfere with an accurate EO count.

BA and BA%: Immature cell, metamyelocytes, myelocytes, promyelocytes, blasts and plasma cells may interfere with an accurate BA count and BA%.

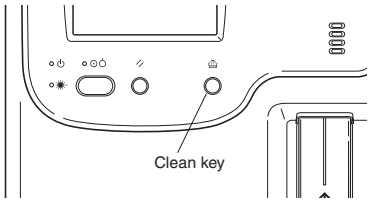
Storing and Transporting the Hematology Analyzer

WARNING

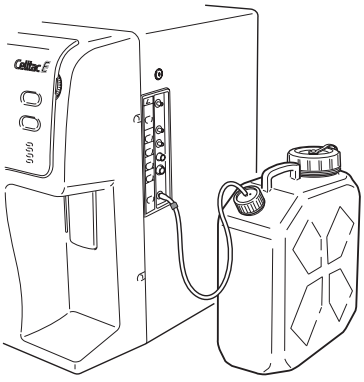
This procedure must be performed to safely store and transport the hematology analyzer. There are many expensive units installed in the hematology analyzer. If there is any malfunction caused from not doing this procedure, the expense necessary for performing maintenance for that damage will be charged to you.

When storing and transporting the hematology analyzer is necessary after demonstration, clean it by the following procedures. Clean the inside of the hematology analyzer only with distilled water. After cleaning, make sure that all distilled water is completely drained from the hematology analyzer.

If diluent is left inside the hematology analyzer, the inside of the hematology analyzer will become dirty because of dried diluent crystal or other dust. This increases background noise.



1. Press the Clean key ( ) on the front panel to clean the fluid path.



2. Remove the diluent tube from the ISO3 inlet, the hemolysing reagent tubes from the HEMO3 (or HEMO3N) and HEMO5 inlets, and the detergent tubes from the CLN3 and CLN inlets on the right side panel.

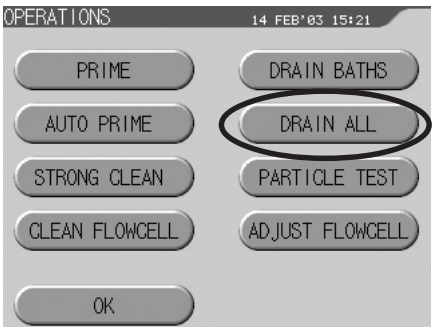
   Do not disconnect the waste fluid tube from the WASTE outlet.

CAUTION

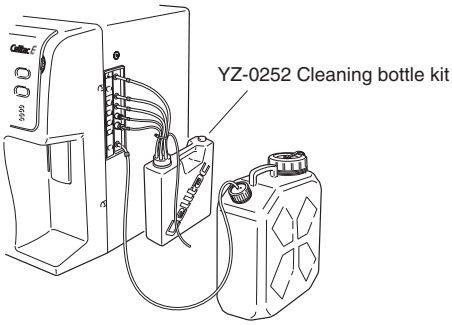
Make sure that the waste fluid tube is correctly connected.

NOTE

- **To handle the diluent container, detergent container and waste container, follow the instructions on each package.**
- **To handle the Hemolynac•3 (or Hemolynac•3N) and Hemolynac•5 hemolysing reagents, follow the instructions in the operator's manual for each hemolysing reagent.**



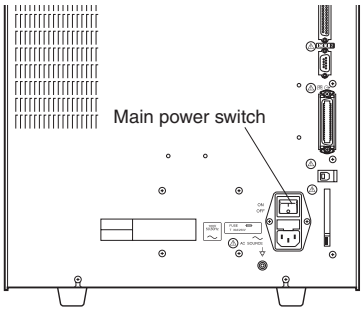
3. Press the DRAIN ALL key on the OPERATIONS screen, and press YES key. The hematology analyzer starts draining all fluid.



4. Connect the spare tubes to the ISO3, HEMO3 (or HEMO3N), HEMO5, CLN and CLN3 inlets and put the other ends of the tubes into the distilled water. (The optional YZ-0252 Cleaning bottle kit is available for easy setup.)

5. Press the Clean key on the front panel to prime the hematology analyzer with distilled water.

6. Repeat steps 2 and 3 to drain all fluid from the hematology analyzer.



7. Press the main power switch on the rear panel to turn the main power off.

MEK-7222J/K Hematology Analyzer Installation Check Sheet

Use this check sheet to check that the hematology analyzer is properly installed. The values in the gain adjustment and calibration should always be entered as they are useful in troubleshooting.

Facility/Hospital Name: _____ Serial Number: _____

Delivery Date: _____ Person in charge of installation: _____

Checking Items					OK	Not OK
Preparing the hematology analyzer						
1	Connect tubes					
2	Connect power cord and grounding lead					
3	Turn laser switch on					
4	Turn power on					
Date and Time Check and Cleaning						
1	Check date and time settings					
2	Clean fluid path in the hematology analyzer					
Adjusting gain and measuring background noise						
1	Count polymer microsphere suspensions	Item	Value	Standard range		
		FS CV%		<7.0%		
		FS peak		61±3		
		FL CV%		<7.0%		
		FL peak		90±3		
2	Adjust flow cell unit position (CV% of FS and FL are <7.0%)					
3	Adjust FS and FL gain in rough mode	FS peak		61±3		
		FL peak		90±3		
4	Measure background noise	WBC		$<0.2\times10^3/\mu L$		
		RBC		$<0.05\times10^6/\mu L$		
		HGB		<0.1 g/dL		
		PLT		$<10\times10^3/\mu L$		
		TOC		<100		
5	Adjust FS, FL and SD gain in fine mode					
6	Check the gain adjustment	MO peak	AVE	AIM		
		FS		186 to 192		
		FL		47 to 51		
		SD		21 to 23		
Calibration						
1	Measure MEK-3DN hematology control					
2	Calibrate CBC parameters	Parameter		Calibration coefficient		
		WBC				
		RBC				
		HGB				
		HCT				
		PLT				
3	Calibrate WBC 5 part differential parameters					
Checking data						
1	Check with MEK-5D hematology control					
2	Check with human blood samples					

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The model and serial number of your instrument are identified on the rear or bottom of the unit. Write the model and serial number in the spaces provided below. Whenever you call your distributor concerning this instrument, mention these two pieces of information for quick and accurate service.

Model _____ **Serial number** _____

Your Distributor

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